Data Visualisation - GGPlot2

Webbinar - corona edition - Thomas Lin Pedersen from R

Grammar of Graphics (ggplot2)

Data import

readr - reading tabulated data
readxl - reading data from excel files
haven - reading data from spss

Data Manipulation

tidyr - tidyverse
dplyr - tidyverse
data.table

The Grammar of Graphics

Data is not just data
Representation defines what can be done with it
Grammar requires a tidy format

Data: Obviously
Aesthetic Mappings: this column represents x-axis, y-axis, etc
Facet mapping: link variables in the data to panels in the facet layout
Statistics: Applying some sort of transformation to the data to be able to plot it correctly, ex. Bar graphs need specified count, so data must contain that count.
Scales: graphical representable property, color, shapes, ex. mercedes -> blue, toyota -> red, etc.
Scales takes into consideration the different types of data
Geometries: how to specify how to interpret the data, ex. geo_point will plot as a point while geo_line will plot as a line (connect the points)
Facets: Splitting the data into different subplots, small multiples of the same data.
Coordinates: Defines the physical mapping of the aesthetics to the paper.
Theme: color of the background, style, pure style.

Importing & Loading with Pacman

```
pacman:: p_load(pacman, dplyr, GGally, ggplot2, ggrepel, patchwork, gifski, ggforce, ggthemes, maps, sf
```

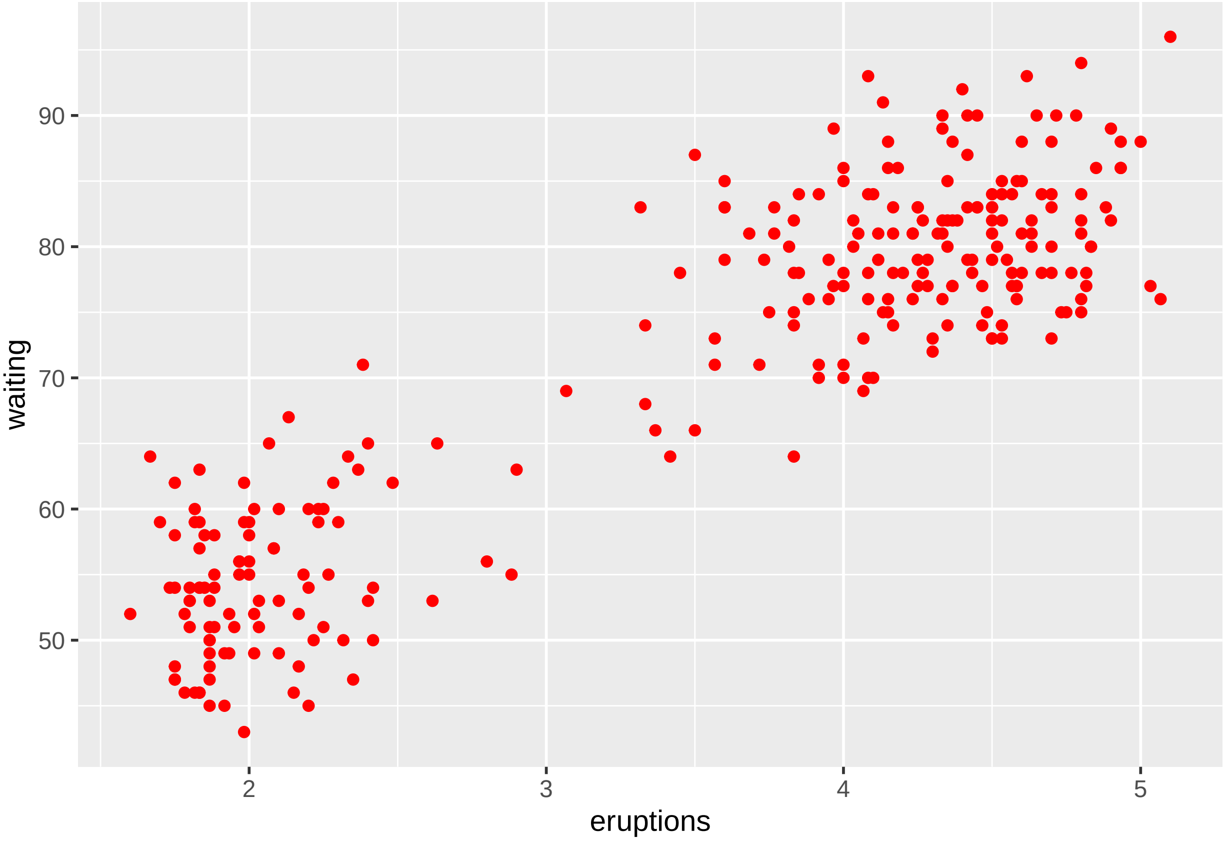
Simple Scatter in GGPlot

Using the example data faithful, the simplest arguments for making a plot are the data, the columns (aesthetics), and the way to read it (geometries)

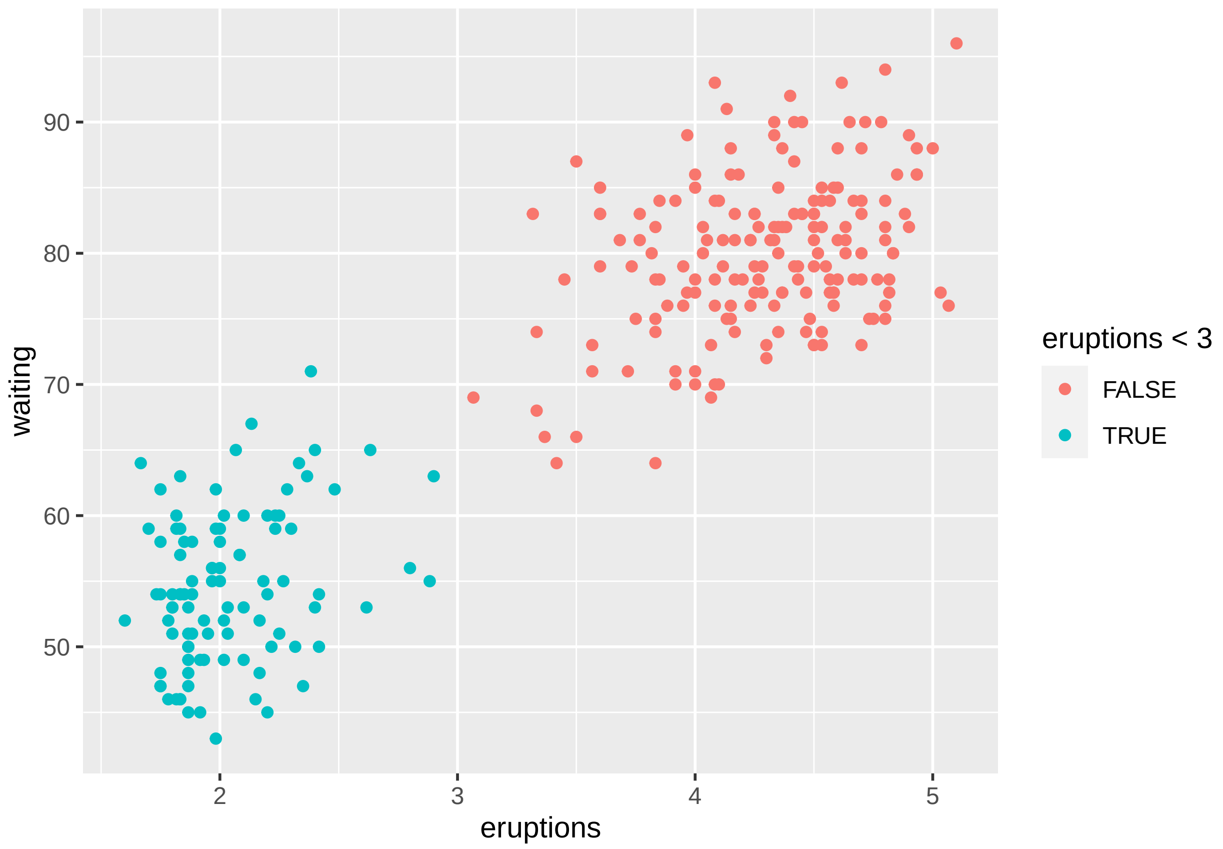
```
head(faithful)
```

```
##   eruptions waiting
## 1     3.600      79
## 2     1.800      54
## 3     3.333      74
## 4     2.283      62
## 5     4.533      85
## 6     2.883      55
```

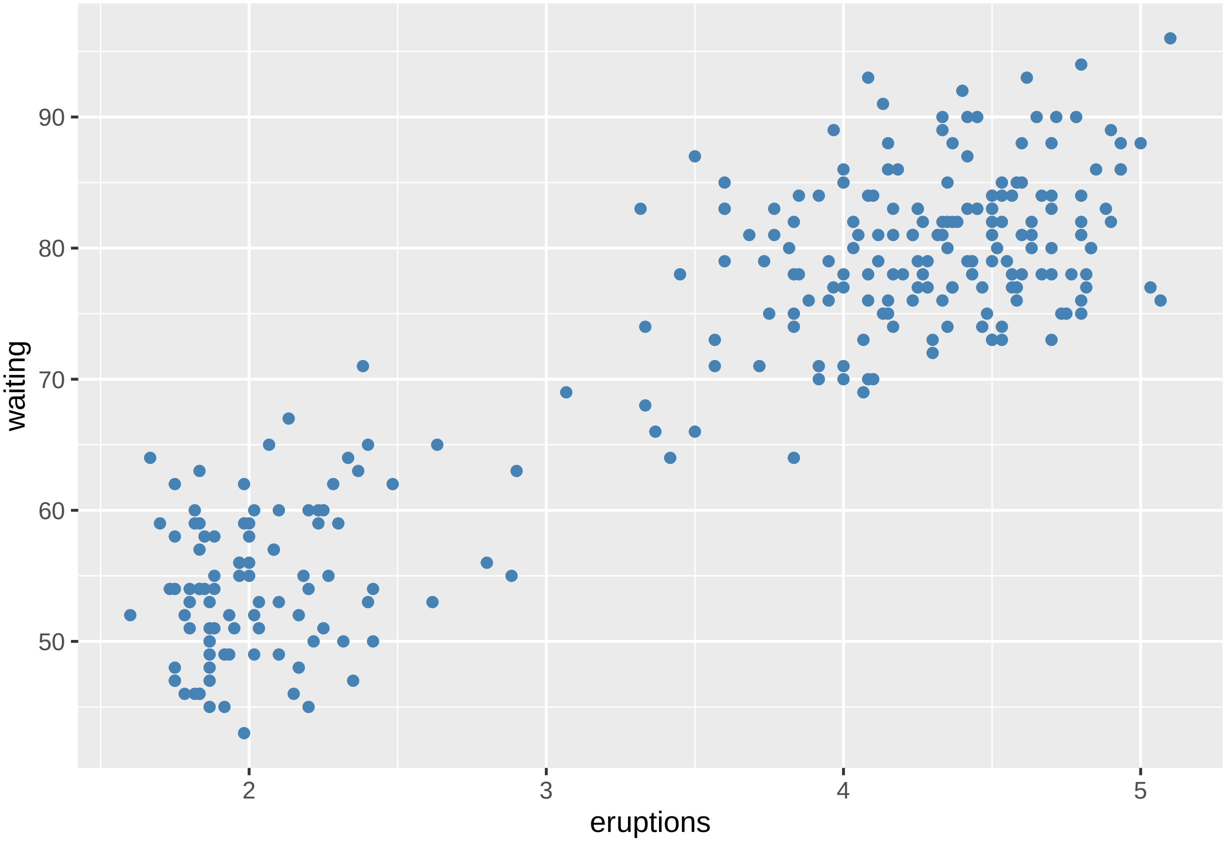
```
ggplot(faithful, aes(eruptions, waiting)) +
  geom_point(color='red')
```



```
ggplot(faithful) +
  geom_point(aes(eruptions, waiting, colour = eruptions < 3))
```



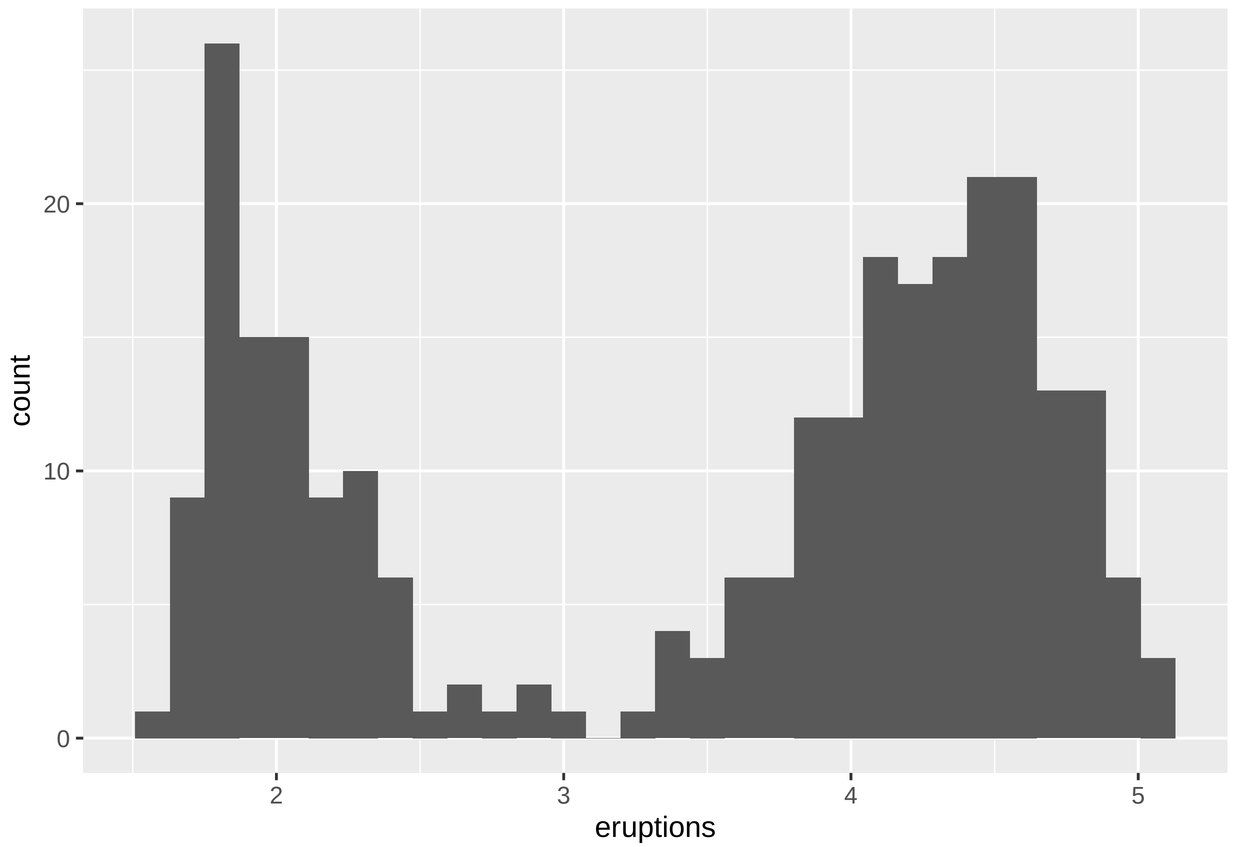
```
ggplot(faithful) +
  geom_point(aes(eruptions, waiting),colour = "steelblue")
```



Histogram

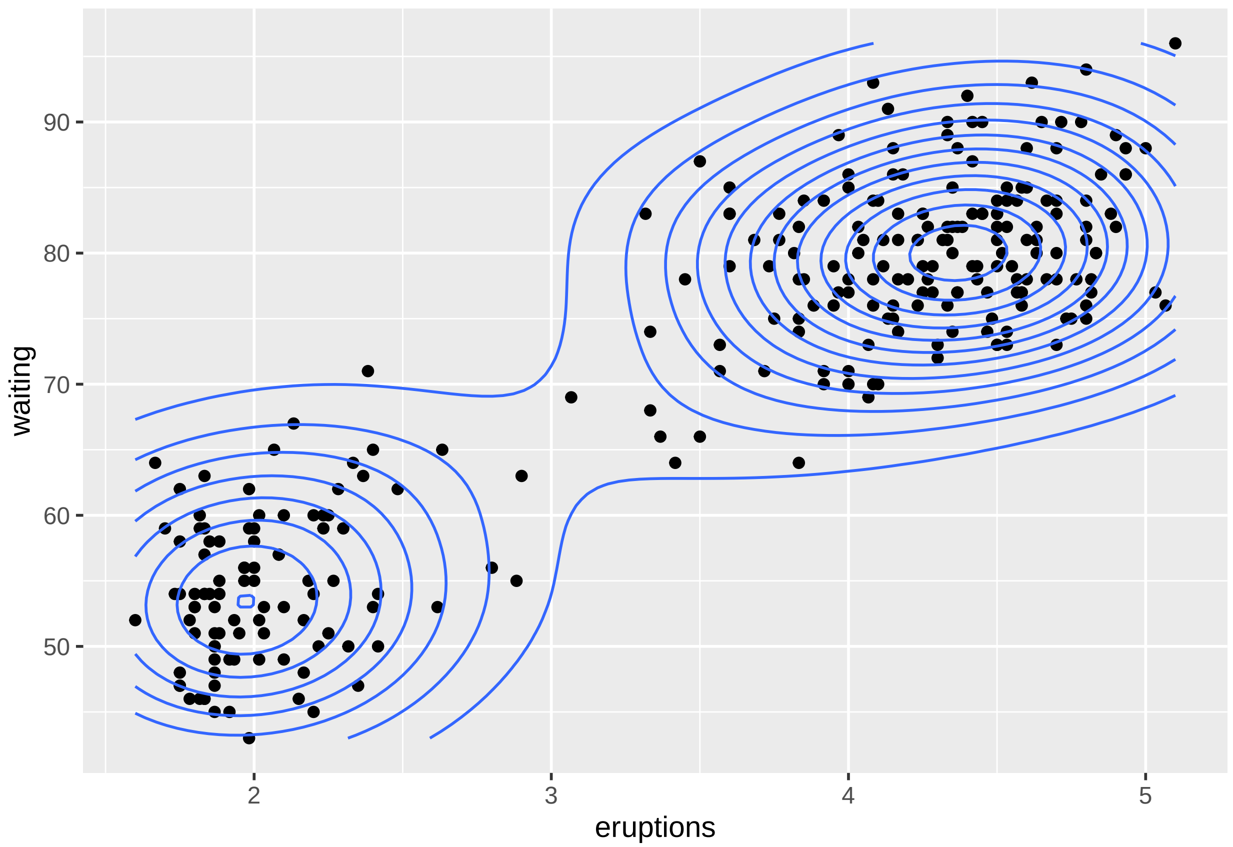
```
ggplot(faithful) +
  geom_histogram(aes(eruptions))
```

```
## ‘stat_bin()‘ using ‘bins = 30‘. Pick better value with ‘binwidth‘.
```



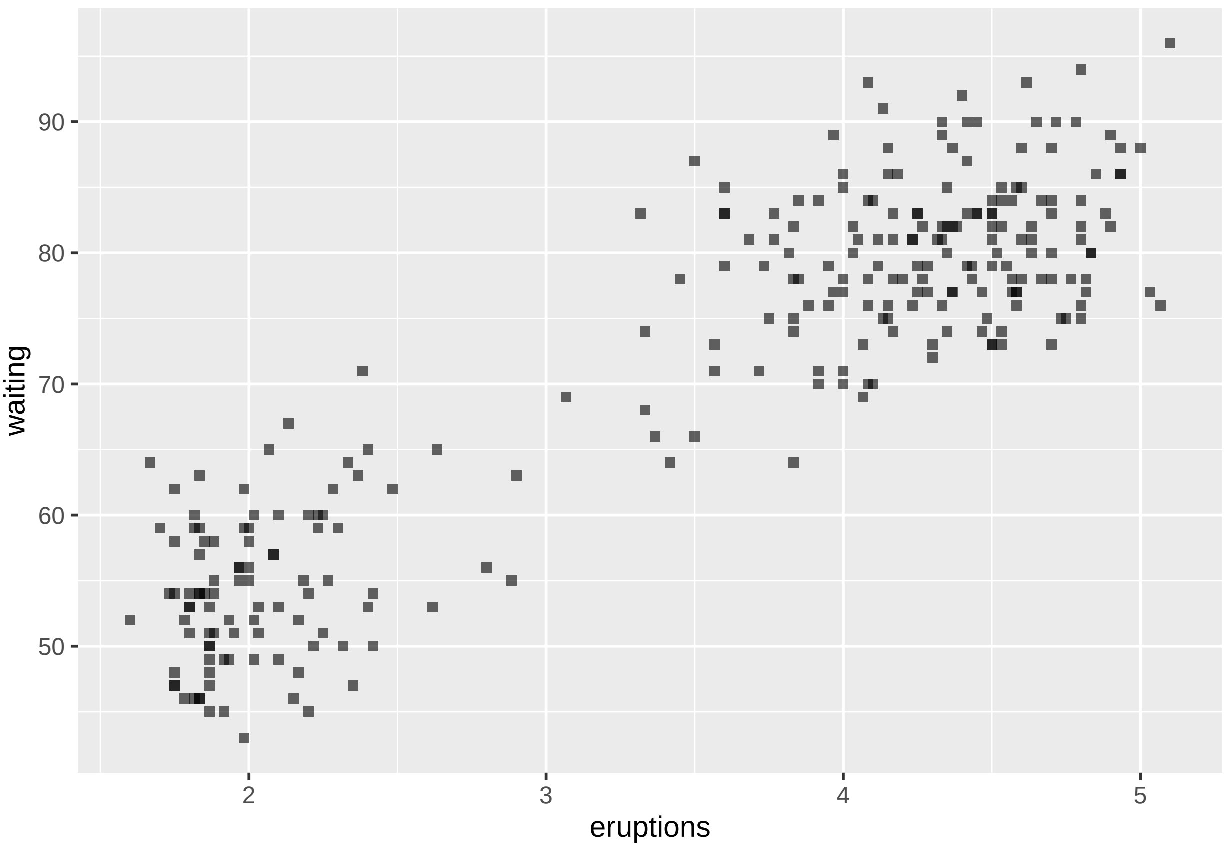
combo

```
ggplot(faithful) + aes(eruptions, waiting) +
  geom_point() +
  geom_density2d()
```



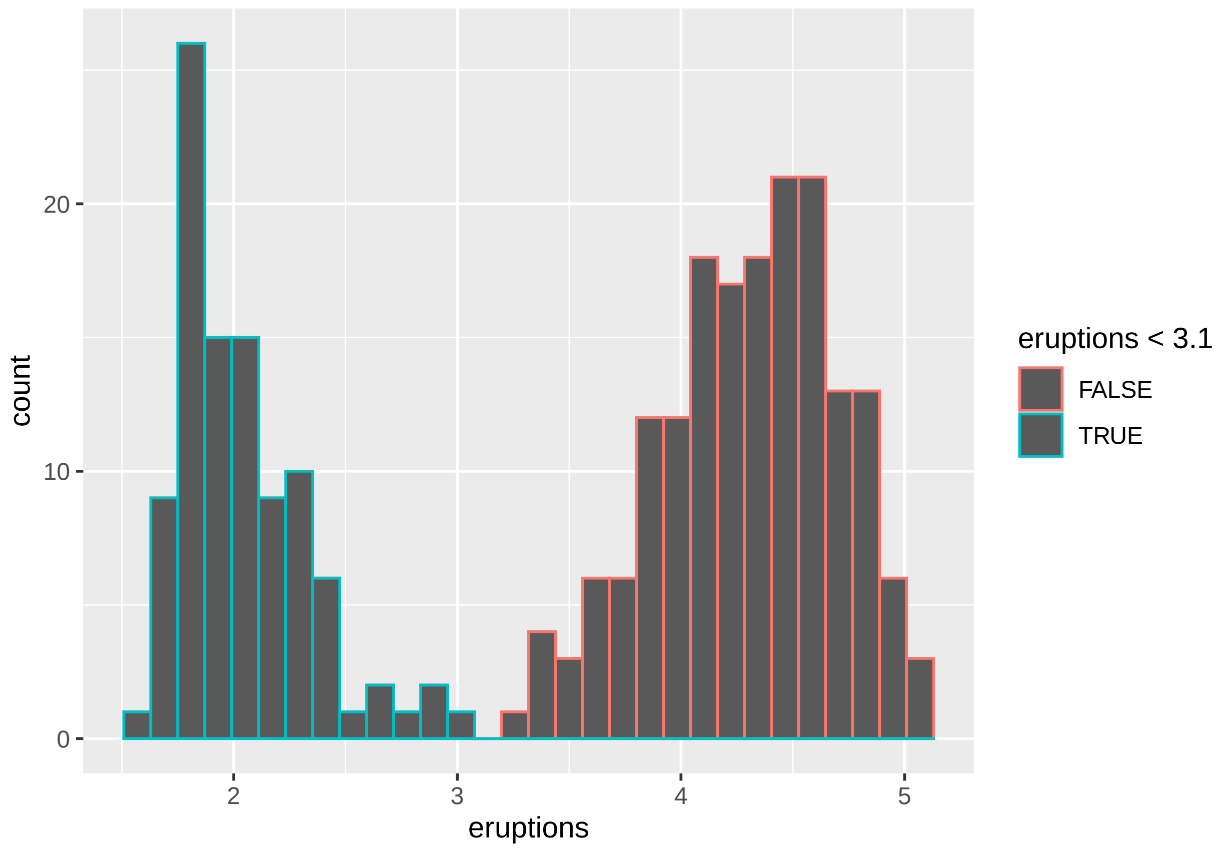
### Exercises

```
ggplot(faithful) +
  geom_point(aes(eruptions, waiting),shape = 'square', alpha = 0.6)
```



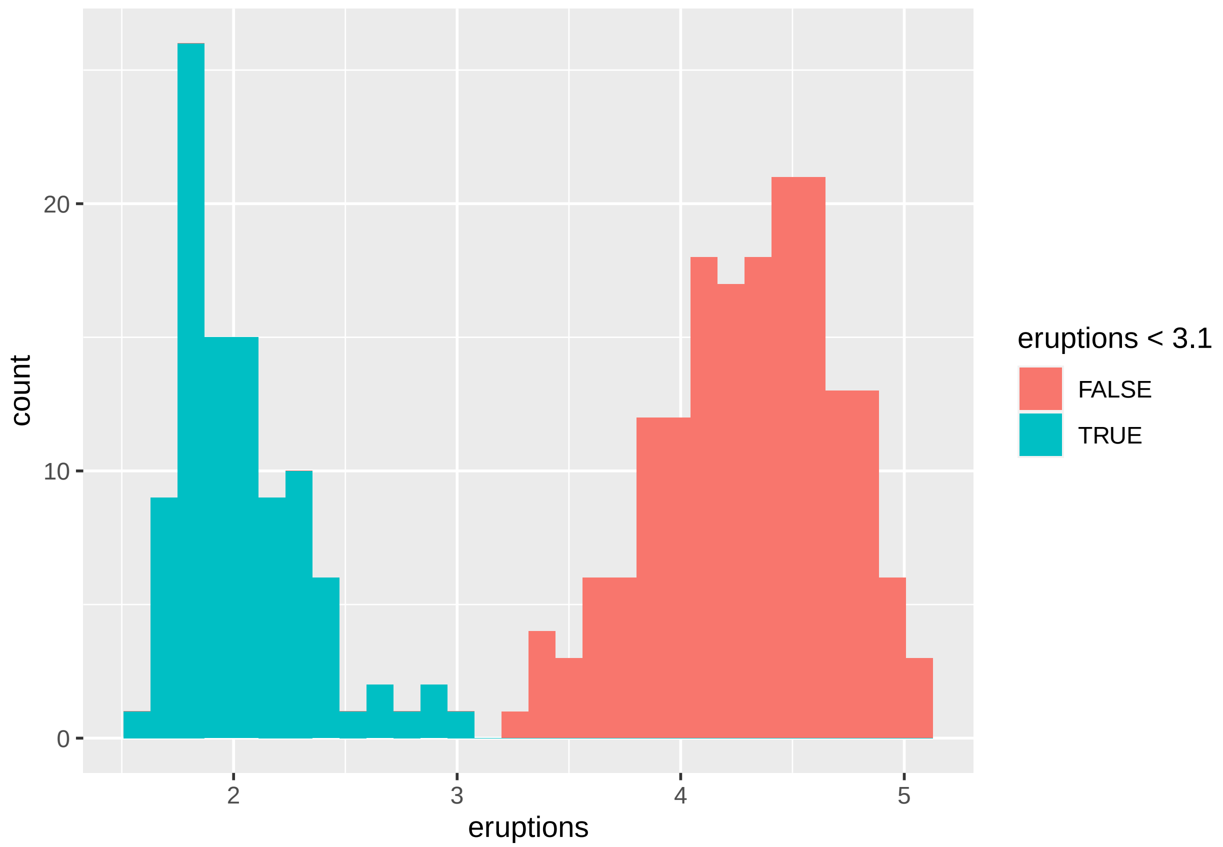
```
ggplot(faithful) +
  geom_histogram(aes(eruptions, colour = eruptions < 3.1))
```

```
## ‘stat_bin()‘ using ‘bins = 30‘. Pick better value with ‘binwidth‘.
```



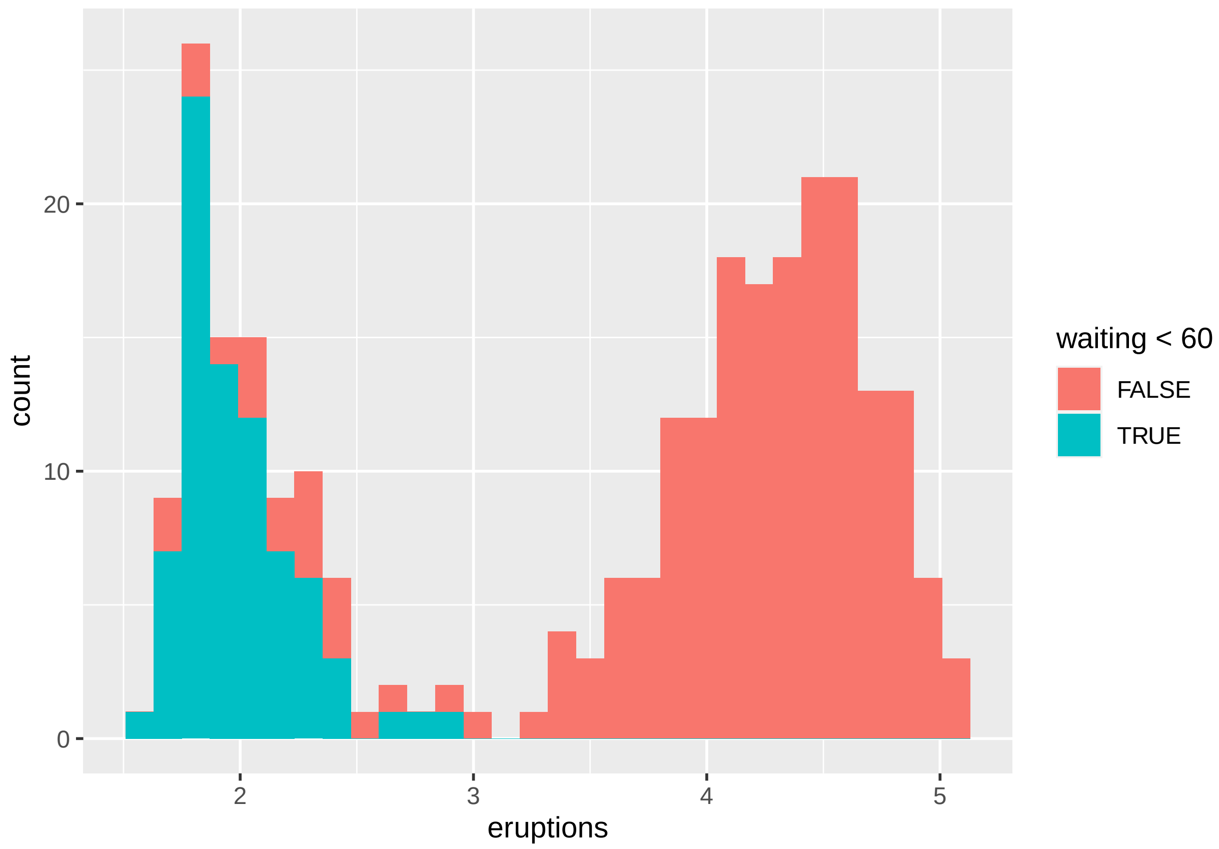
```
ggplot(faithful) +
  geom_histogram(aes(eruptions, fill = eruptions < 3.1))
```

```
## ‘stat_bin()‘ using ‘bins = 30‘. Pick better value with ‘binwidth‘.
```



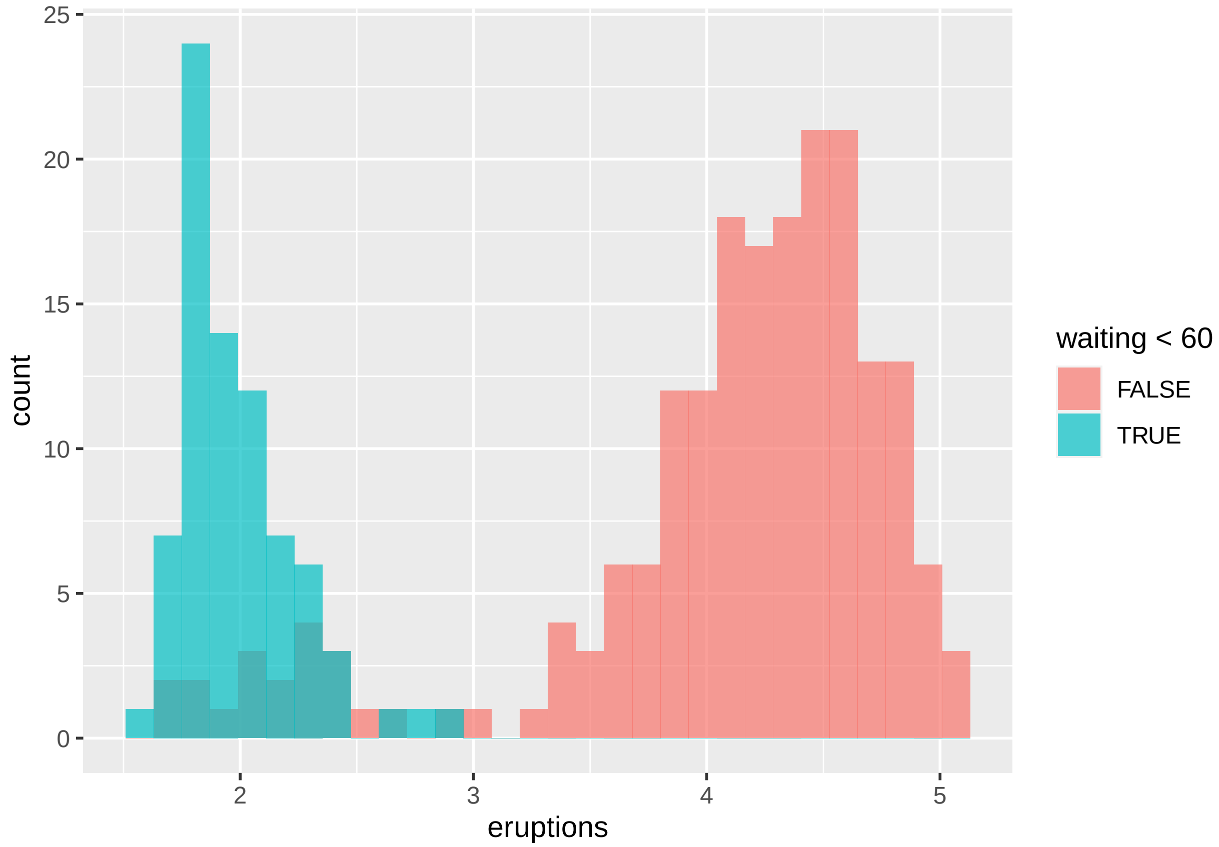
```
ggplot(faithful) +
  geom_histogram(aes(eruptions, fill = waiting < 60))  #Hard to see, but they're stacked together
```

```
## ‘stat_bin()‘ using ‘bins = 30‘. Pick better value with ‘binwidth‘.
```

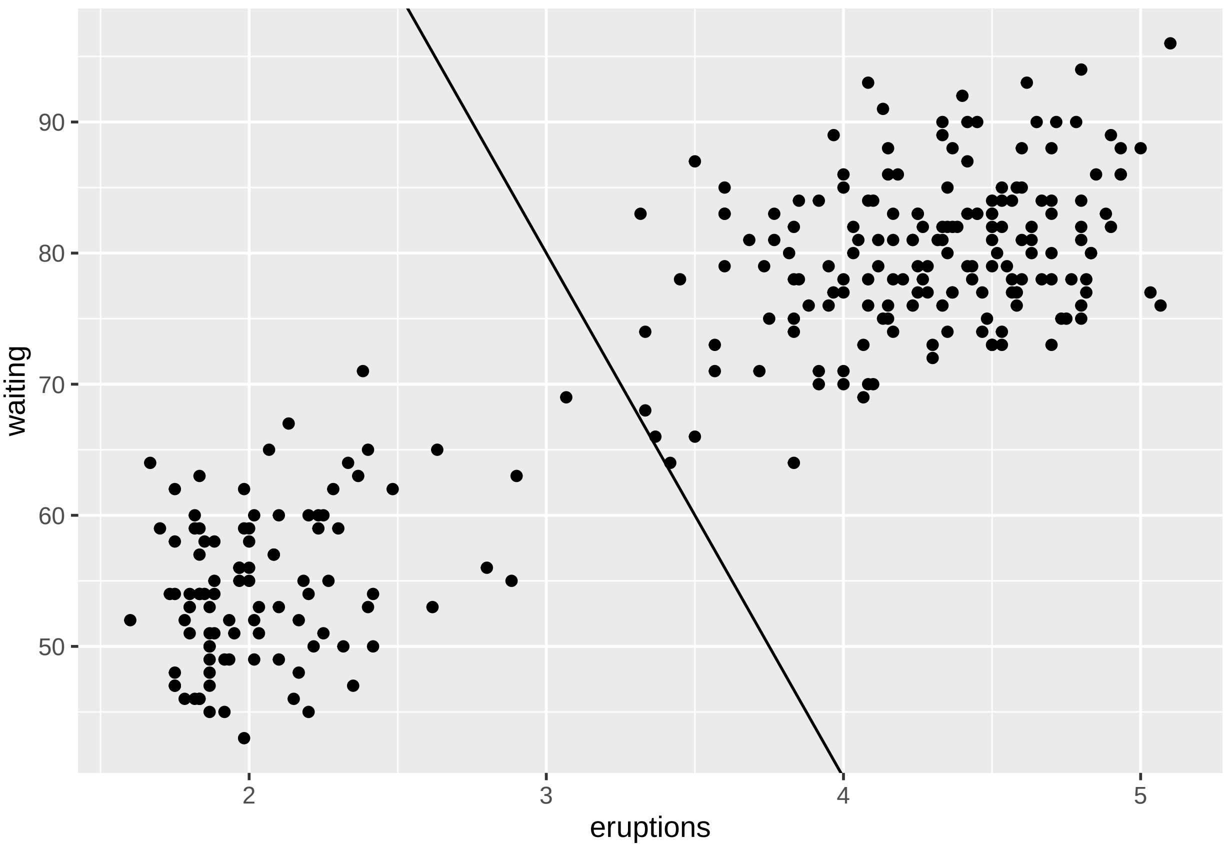


```
ggplot(faithful) +
  geom_histogram(aes(eruptions, fill = waiting < 60), position = 'identity', alpha = 0.7) #Position adj
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



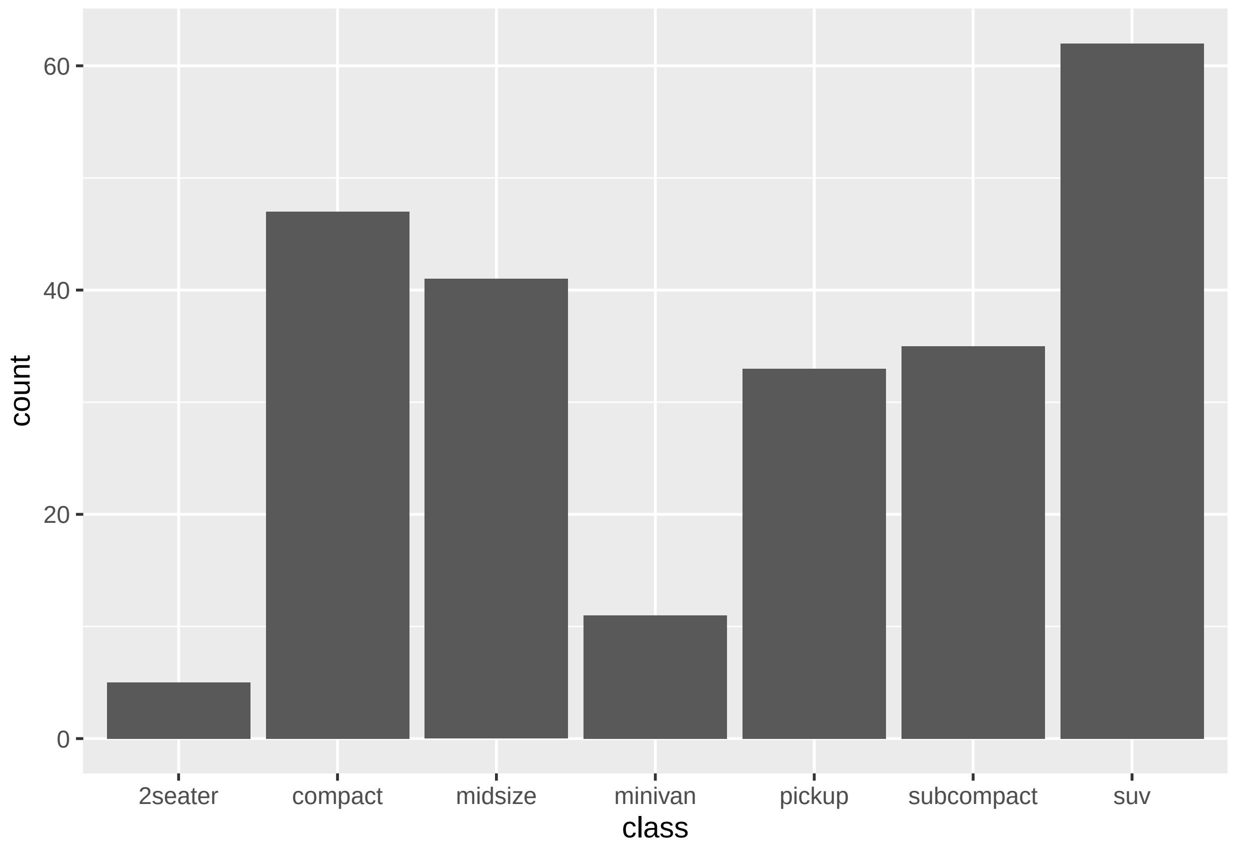
```
ggplot(faithful) +
  geom_point(aes(eruptions, waiting)) +
  geom_abline(slope = -40, intercept = 200)
```



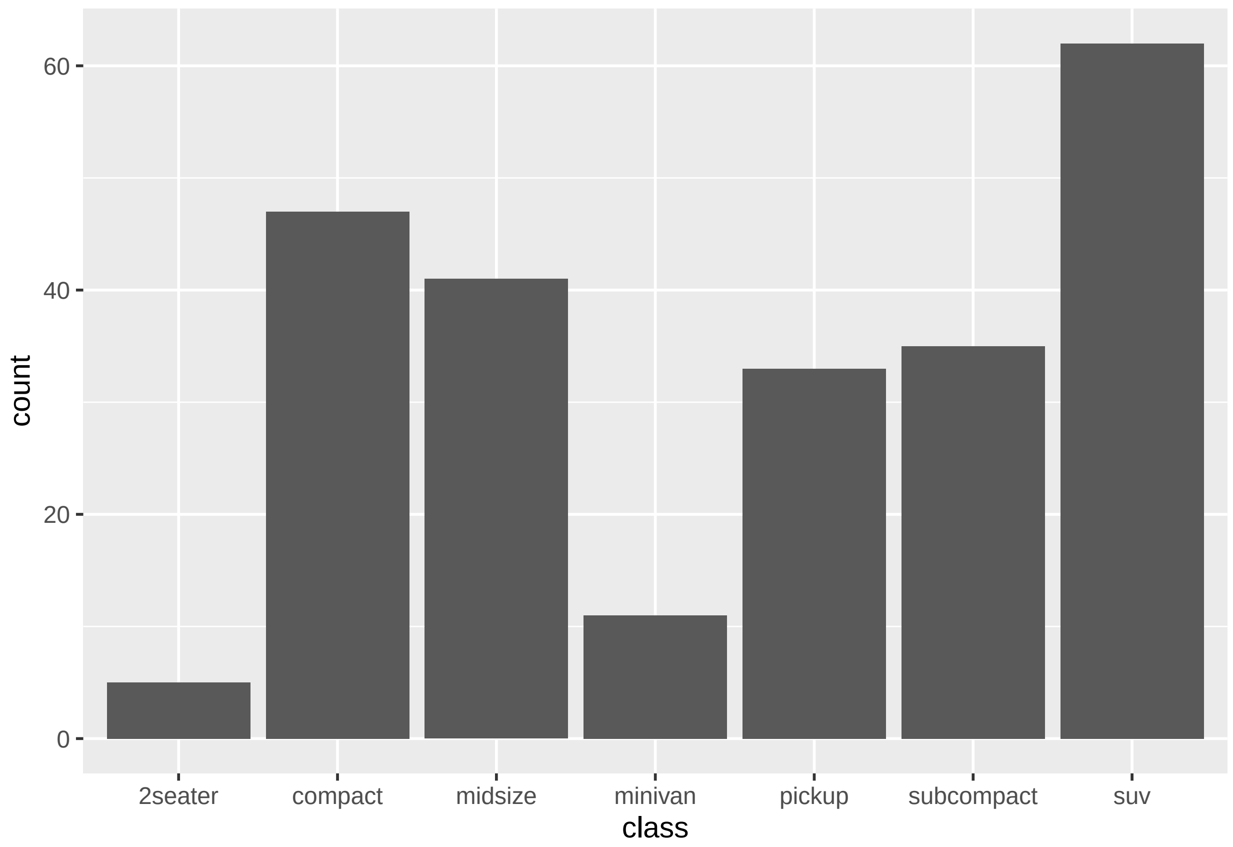
Stats

Here geom_bar() uses stat_count() by default to count all the things inside the data.This is all done in the computer, so the computer loads the data and manipulates it. This is not feasible for enormous amounts of data, so its better to tell the data base to do the calculation and safe it on a different data base.

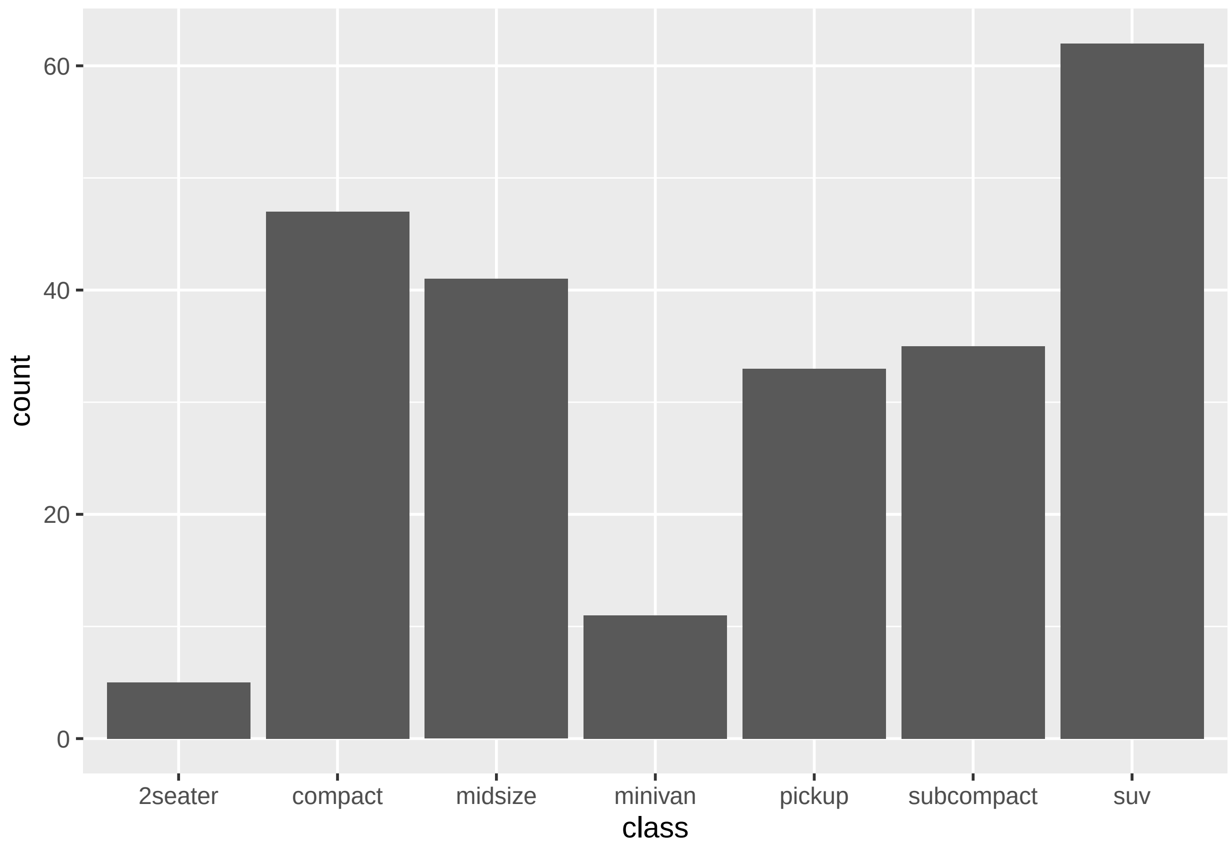
```
ggplot(mpg) +
  geom_bar(aes(class))
```



```
mpg_counted <- mpg %>%
  count(class, name = 'count')

ggplot(mpg_counted) +
  geom_bar(aes(class, count), stat = 'identity')
```

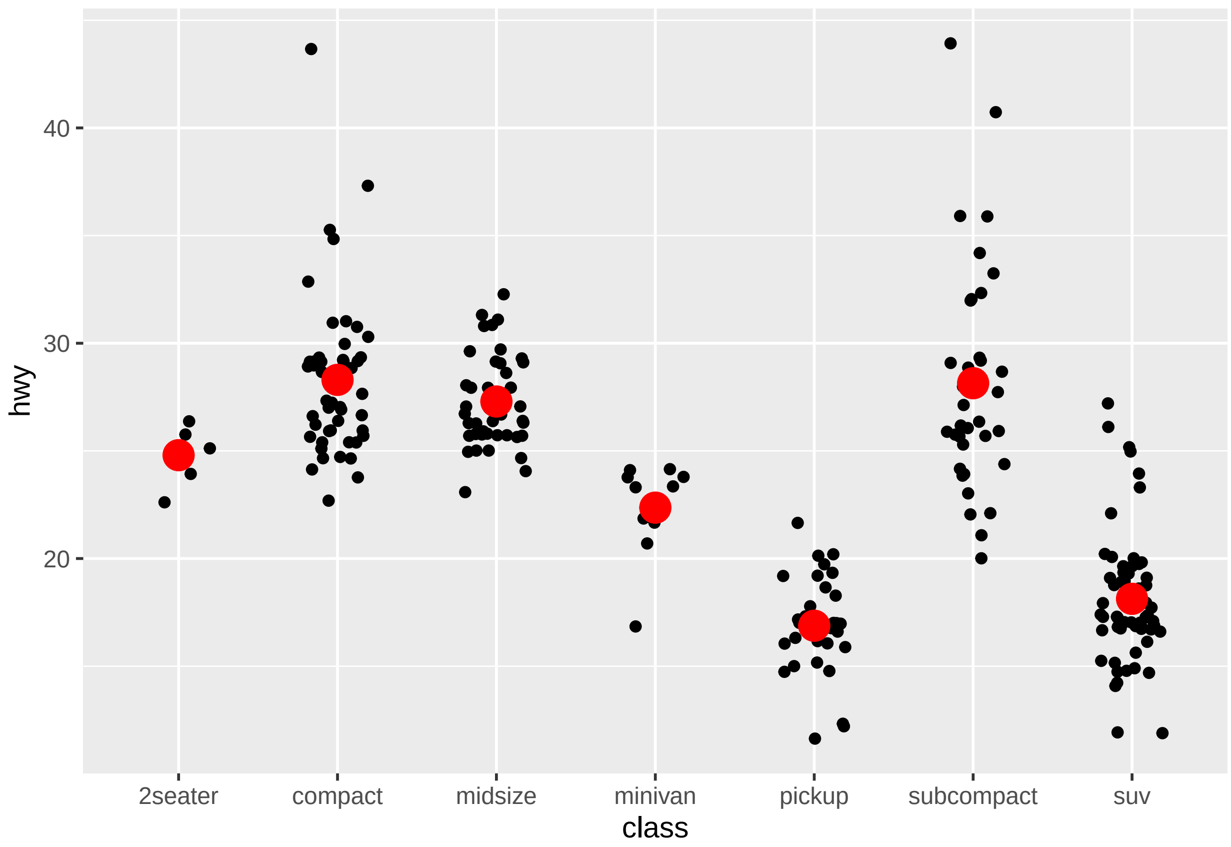


```
ggplot(mpg_counted) +
  geom_col(aes(class, count))  #geom_col() is a shortcut to avoid putting 'identity' manually
```



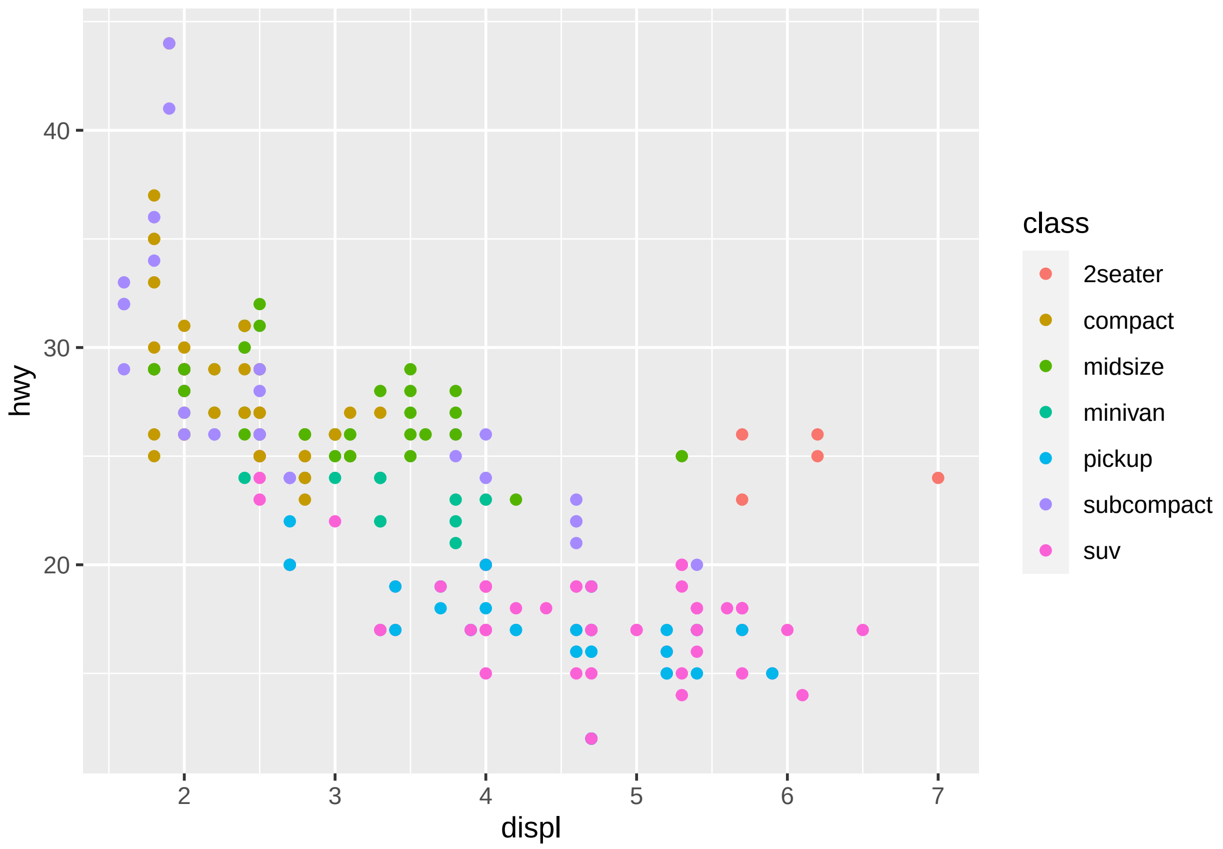
Using stats:

```
ggplot(mpg) +
  geom_jitter(aes(class, hwy),width = 0.2) +
  stat_summary(aes(class, hwy), fun = mean, geom = 'point', colour = 'red', size = 5) # adding a point
```

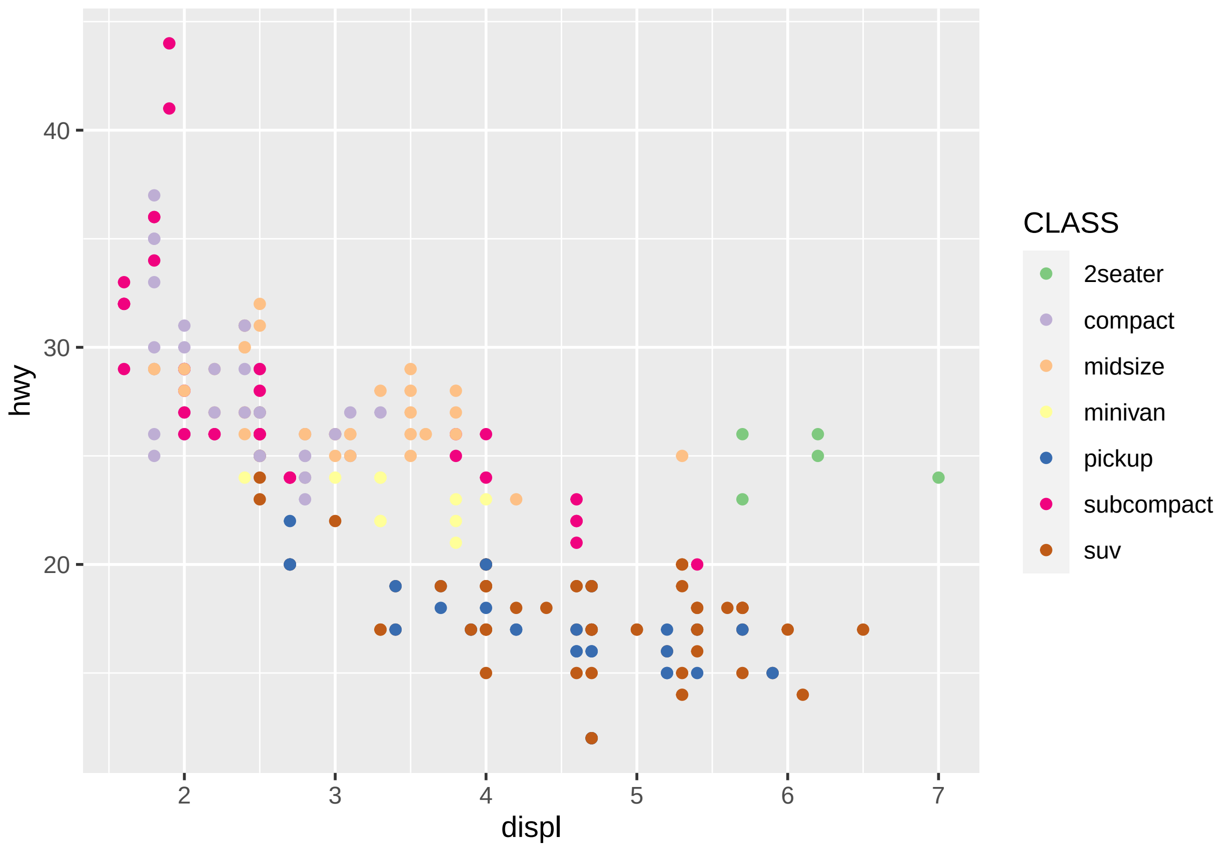


Scales:

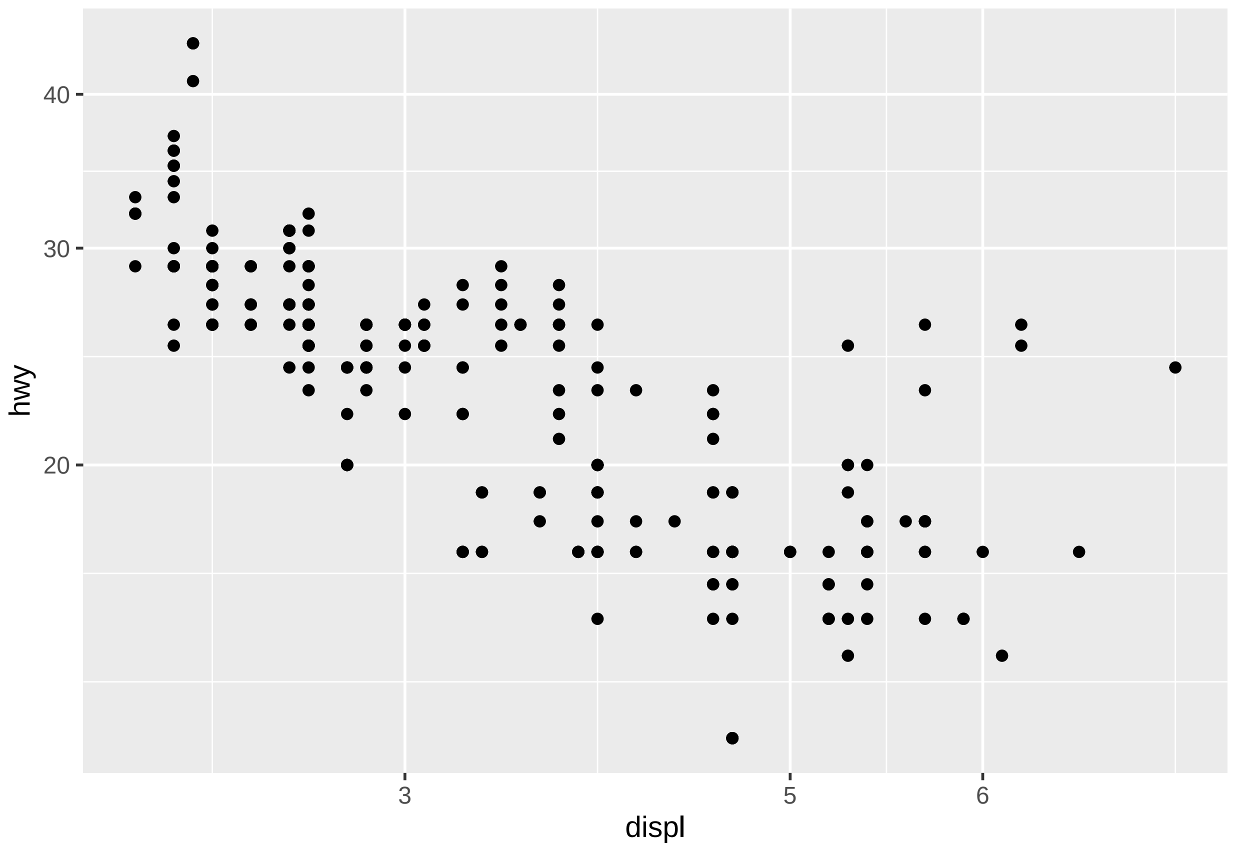
```
ggplot(mpg) +
  geom_point(aes(displ, hwy, colour = class))
```



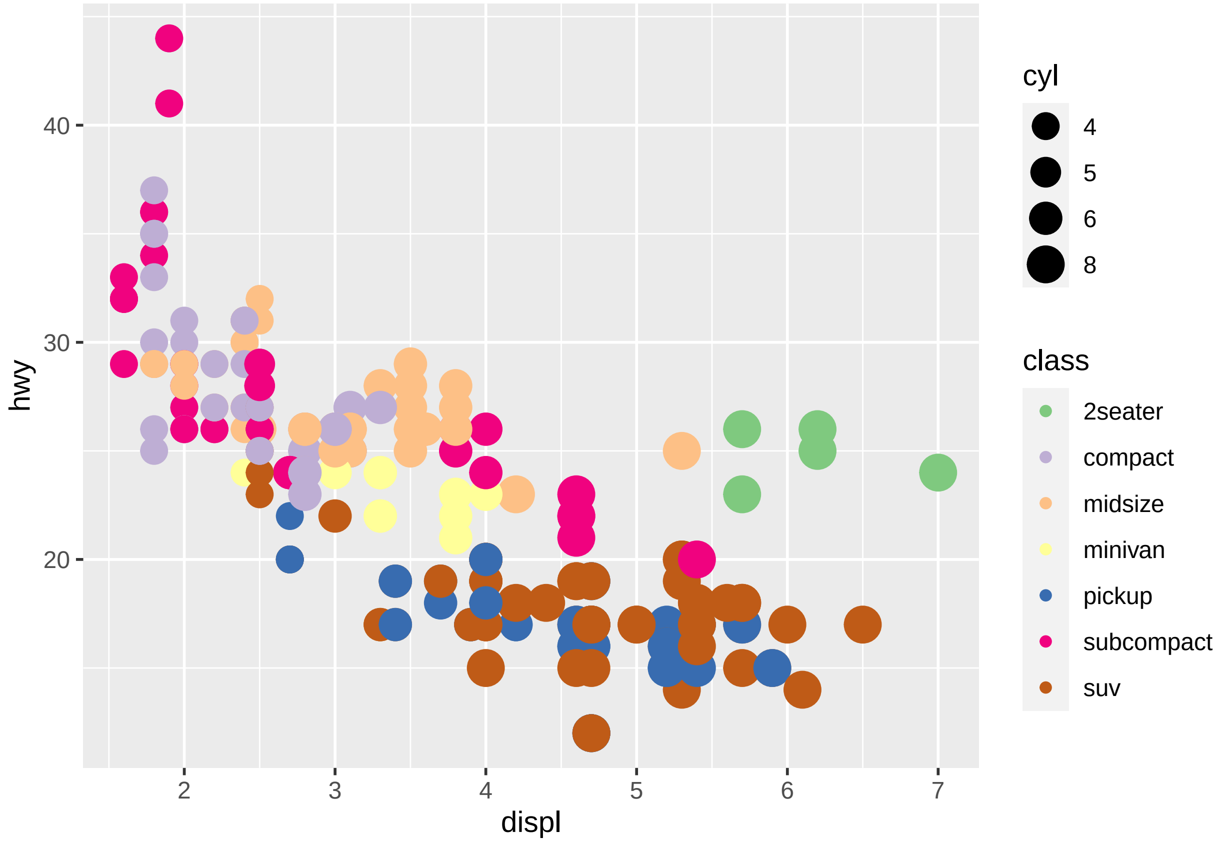
```
ggplot(mpg) +
  geom_point(aes(displ, hwy, colour = class)) +
  scale_colour_brewer(name = 'CLASS', type = 'qual')   #changing the name of the legend and inputing man
```



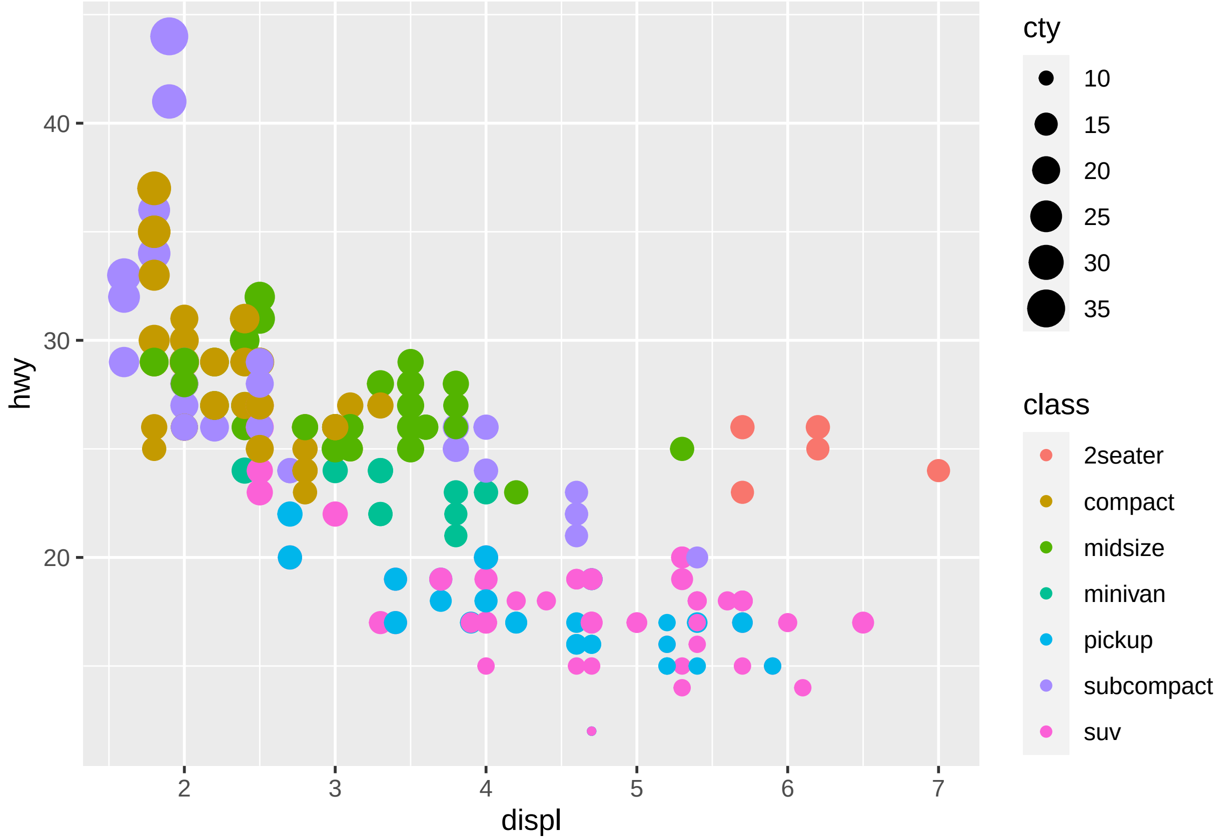
```
ggplot(mpg) +
  geom_point(aes(displ, hwy)) +
  scale_x_continuous(breaks = c(3,5,6))+  #breaks means which numbers you want displayed in the axis.
  scale_y_continuous(trans = 'log10') # trans = transformation
```



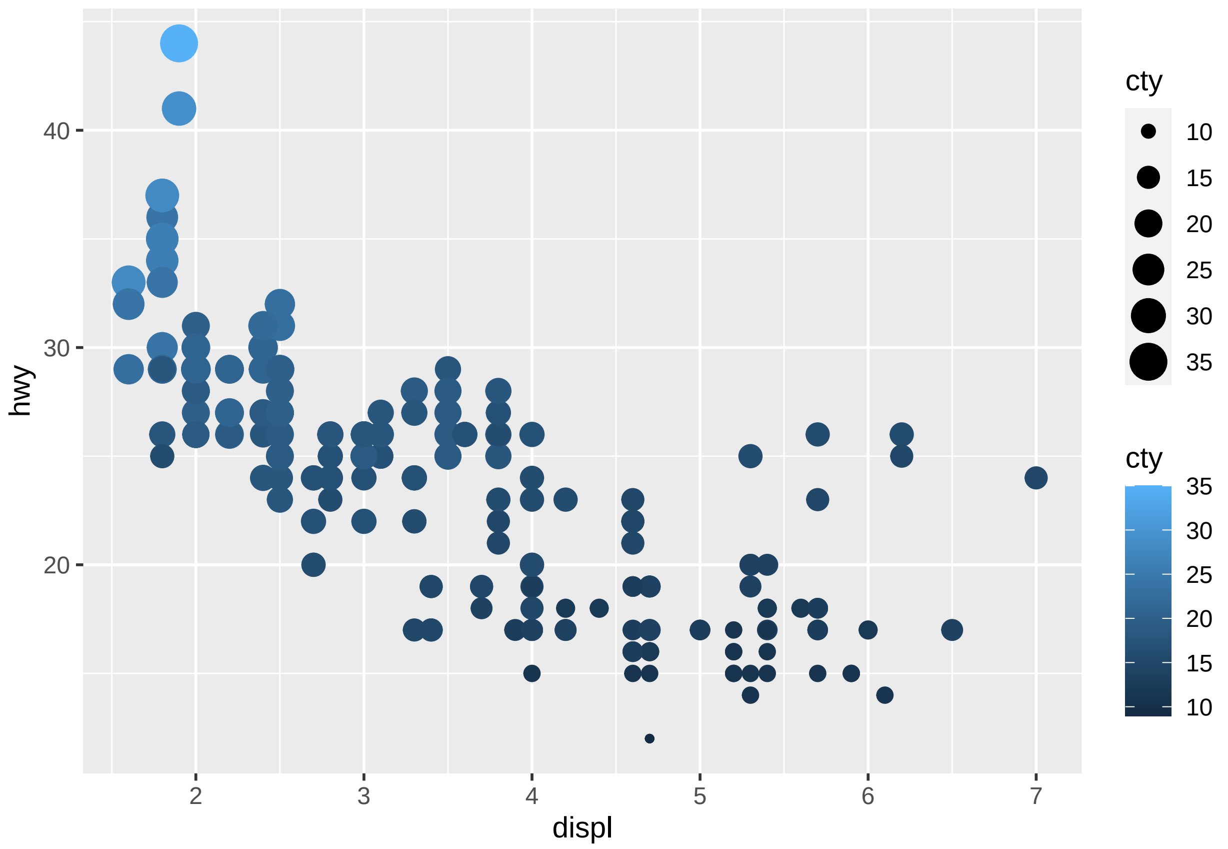
```
#all the display colours
#RColorBrewer::display.brewer.all()

ggplot(mpg) +
  geom_point(aes(displ, hwy, colour = class, size = cyl)) +
  scale_color_brewer(type = 'qual') +
  scale_size_area(breaks = c(4,5,6,8))  #Size is also mapped to a continuous variable only 4,5,6,8
```



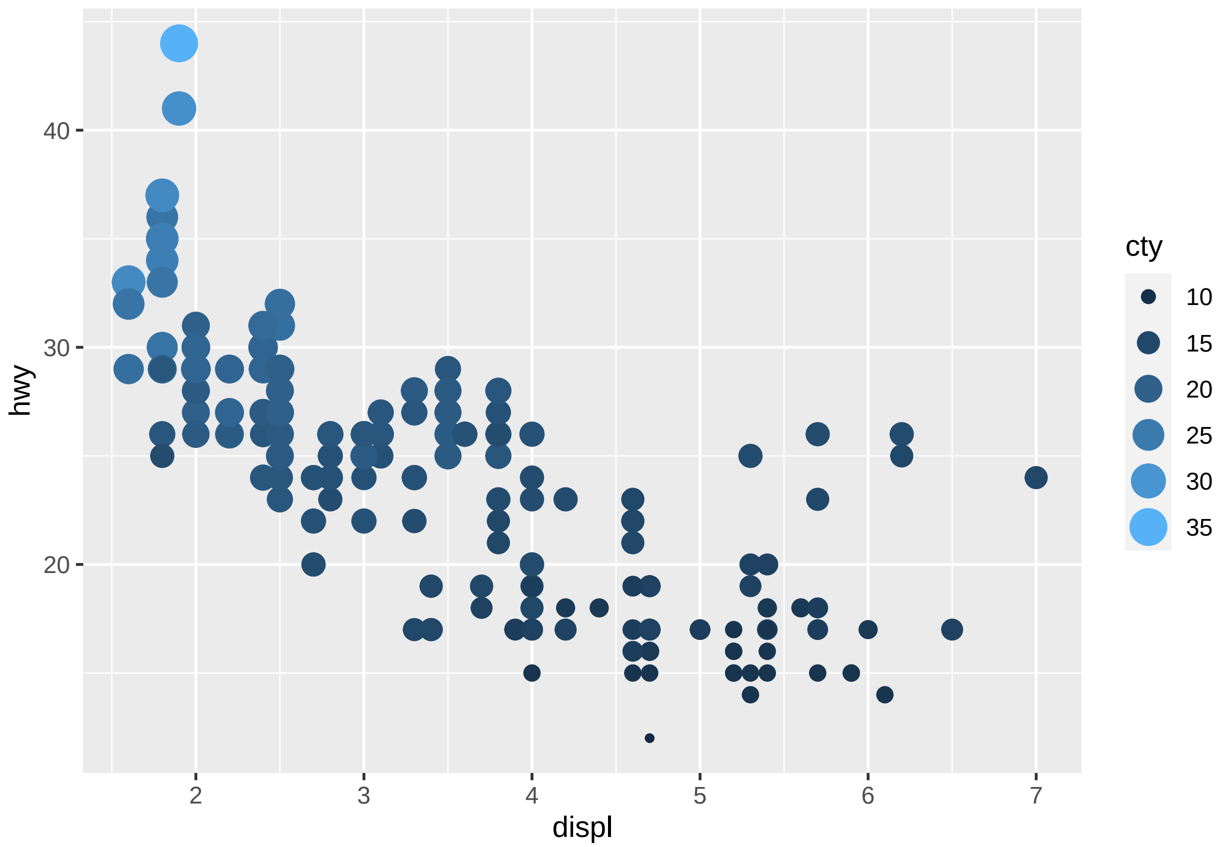
```
ggplot(mpg) +
  geom_point(aes(x = displ, y = hwy, colour = class, size = cty))
```



```
ggplot(mpg) +
  geom_point(aes(x = displ, y = hwy, colour = cty, size = cty))
```

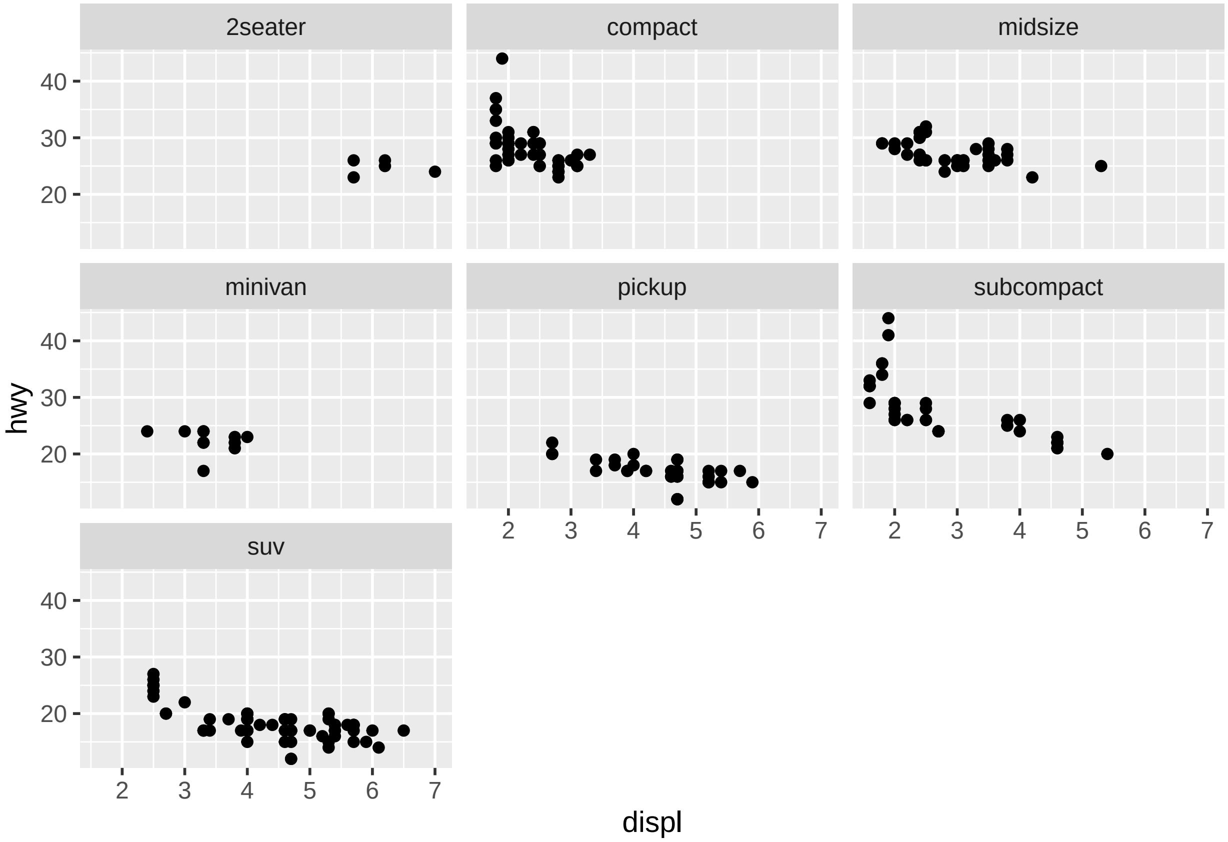


```
ggplot(mpg) +
  geom_point(aes(x = displ, y = hwy, colour = cty, size = cty)) +
  guides(colour = 'legend') #only merges guides if they're exactly the same!
```

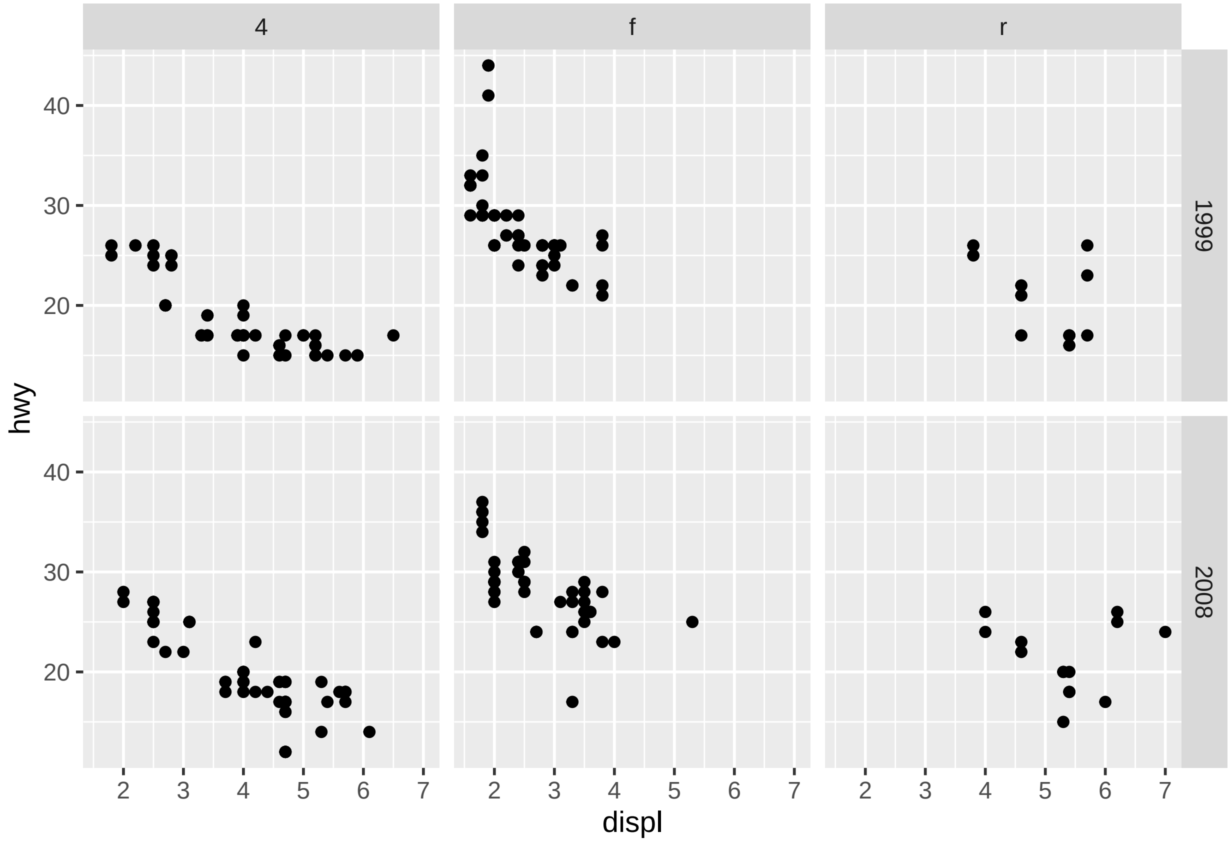


Facets: splitting the data under the same plot, subplots essentially.

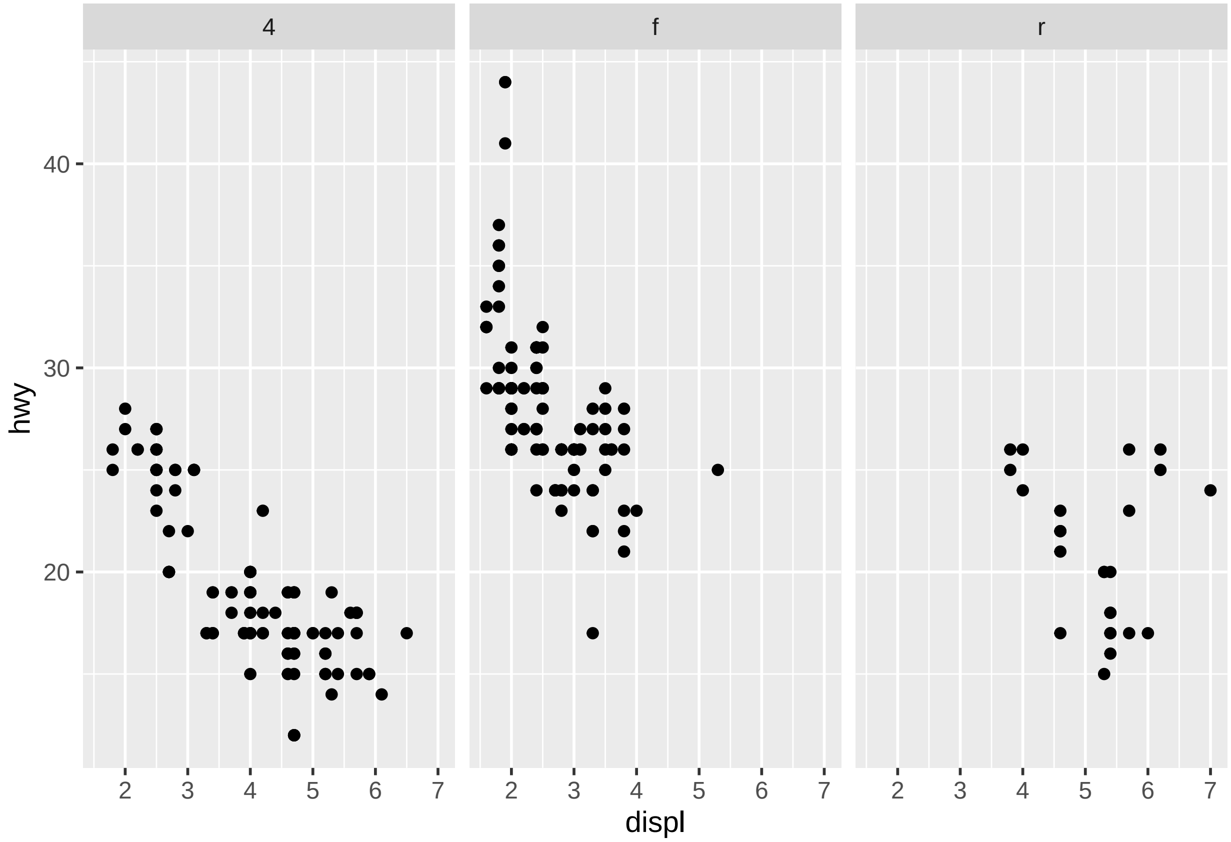
```
ggplot(mpg) +
  geom_point(aes(displ, hwy)) +
  facet_wrap(~ class) #single variable
```



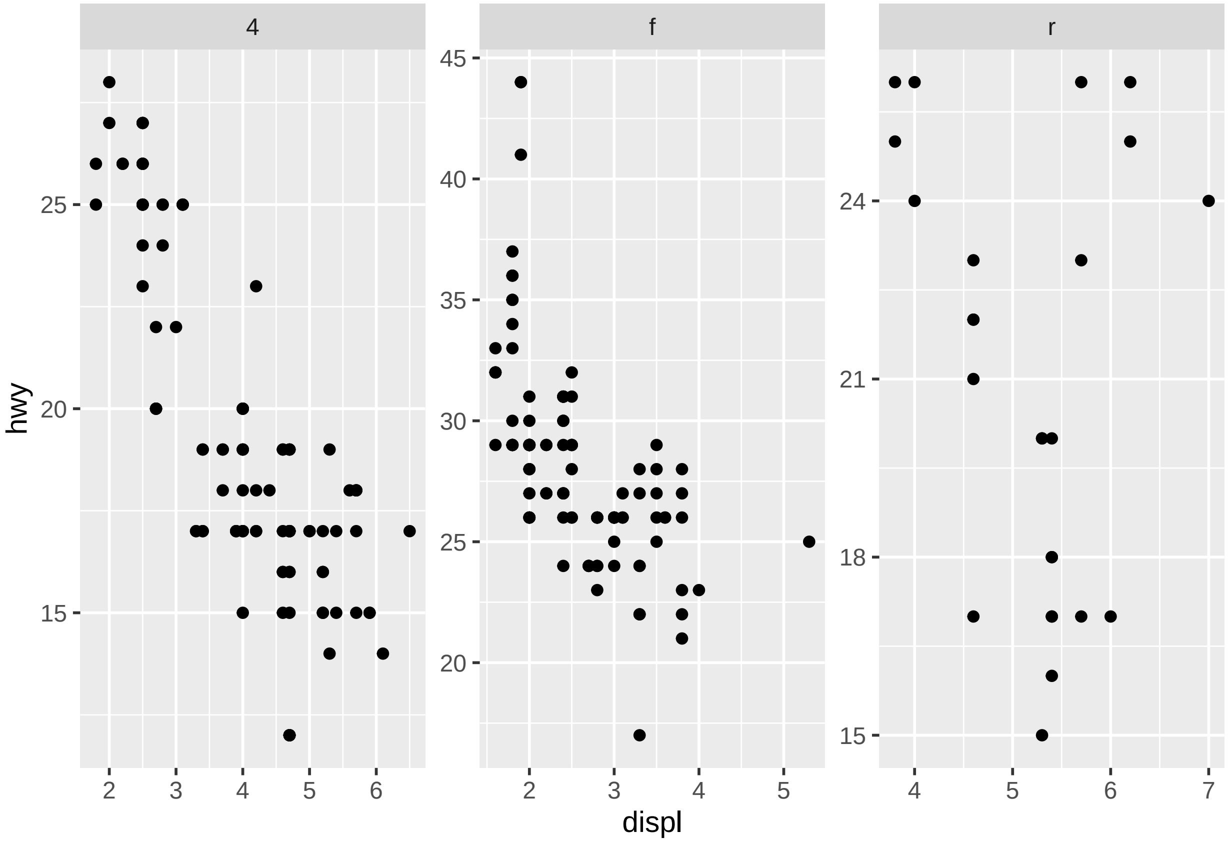
```
ggplot(mpg) +
  geom_point(aes(displ, hwy)) +
  facet_grid(year ~ drv) # two variablies
```



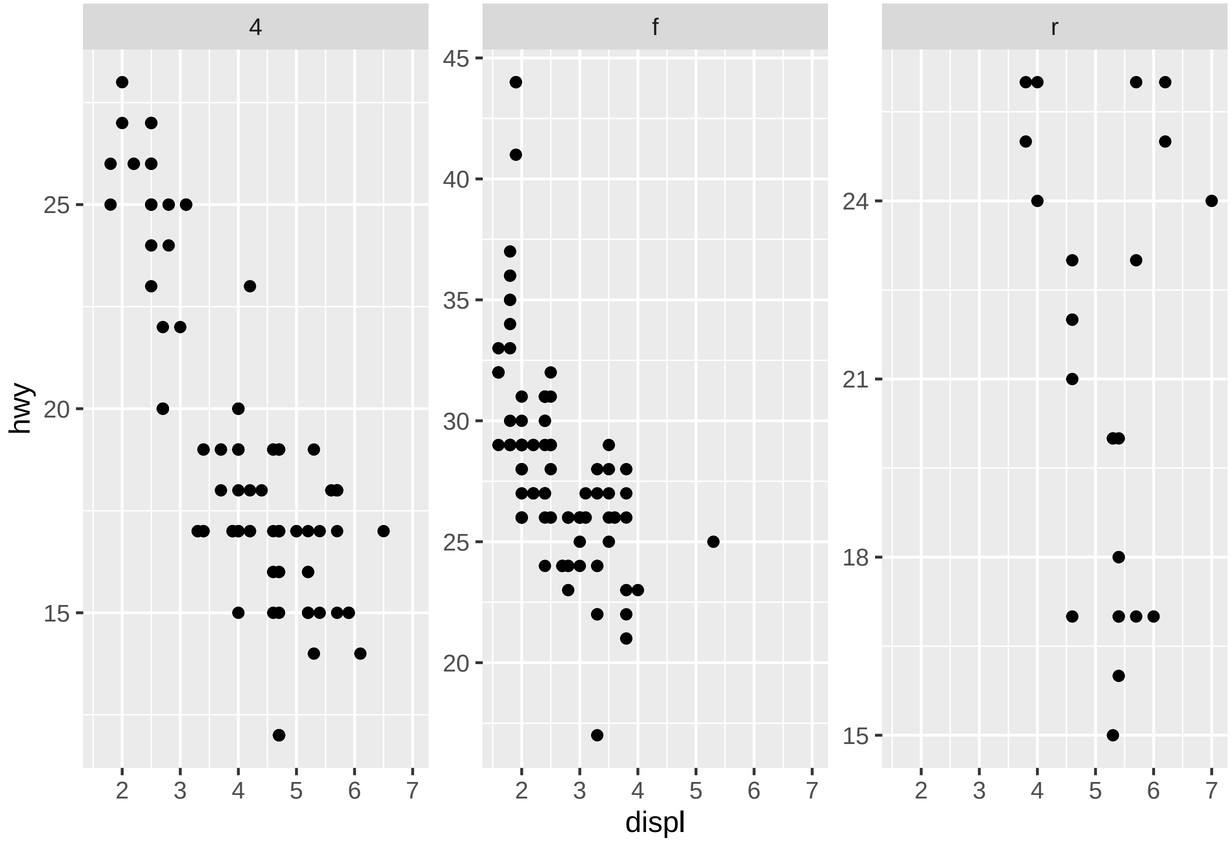
```
ggplot(mpg) +
  geom_point(aes(x = displ, y = hwy)) + # same scale for all
  facet_wrap(~ drv)
```



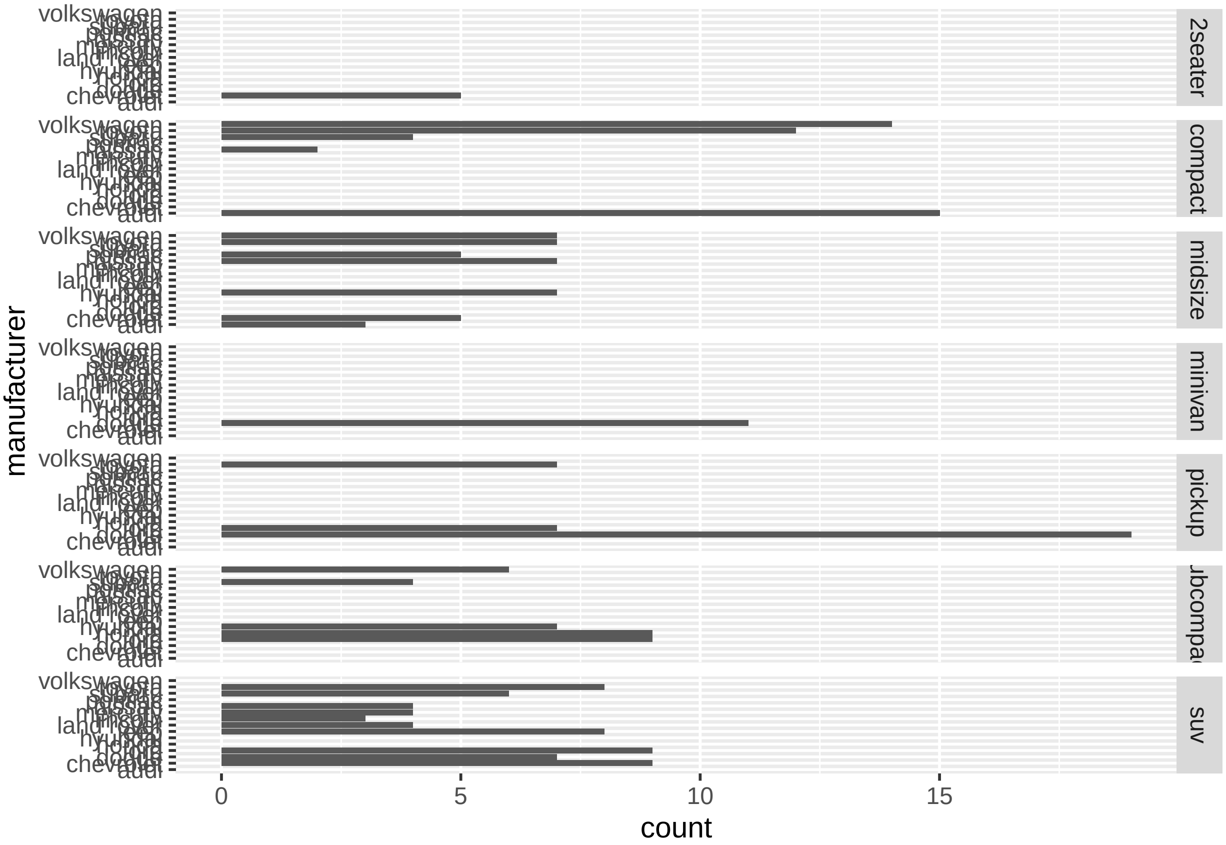
```
ggplot(mpg) +
  geom_point(aes(x = displ, y = hwy)) + #different scales for all
  facet_wrap(~ drv, scales = 'free')
```



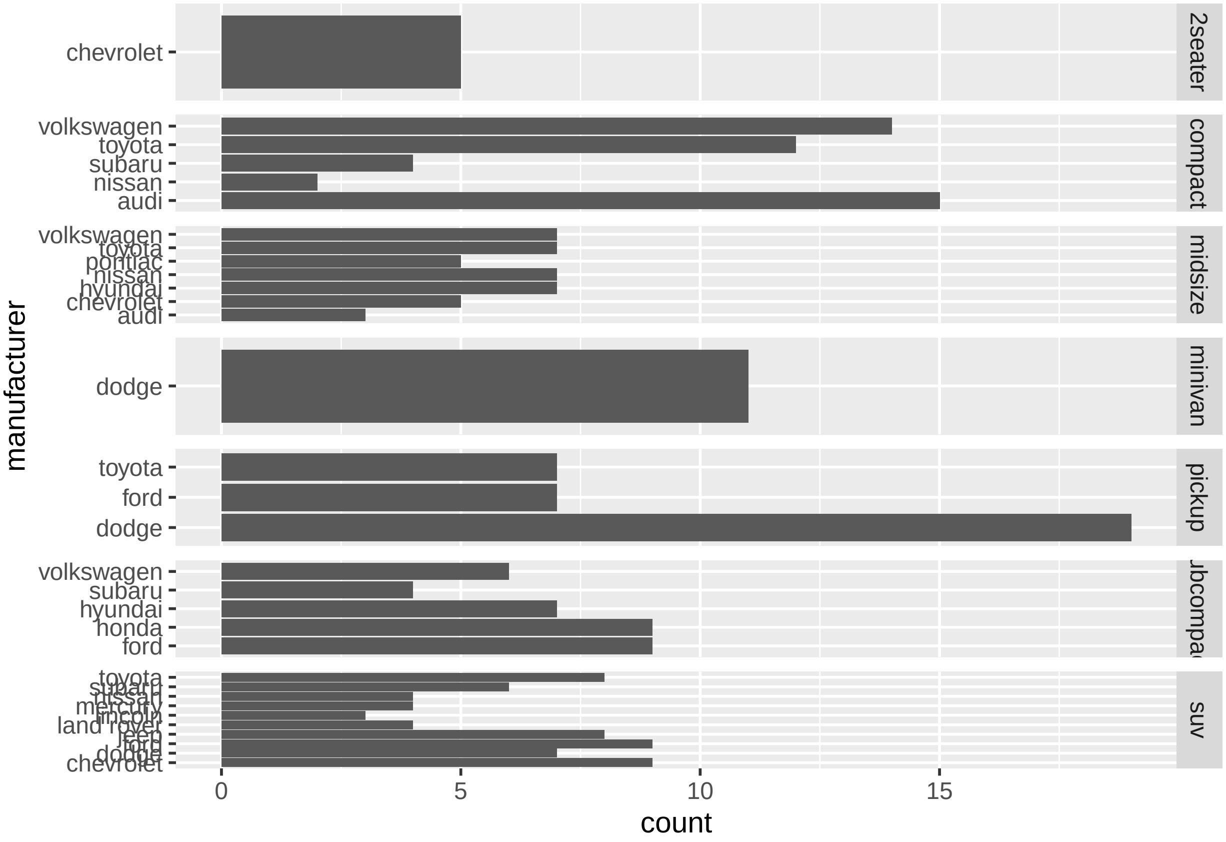
```
ggplot(mpg) +
  geom_point(aes(x = displ, y = hwy)) + #only different y scales but same x scale
  facet_wrap(~ drv, scales = 'free_y')
```



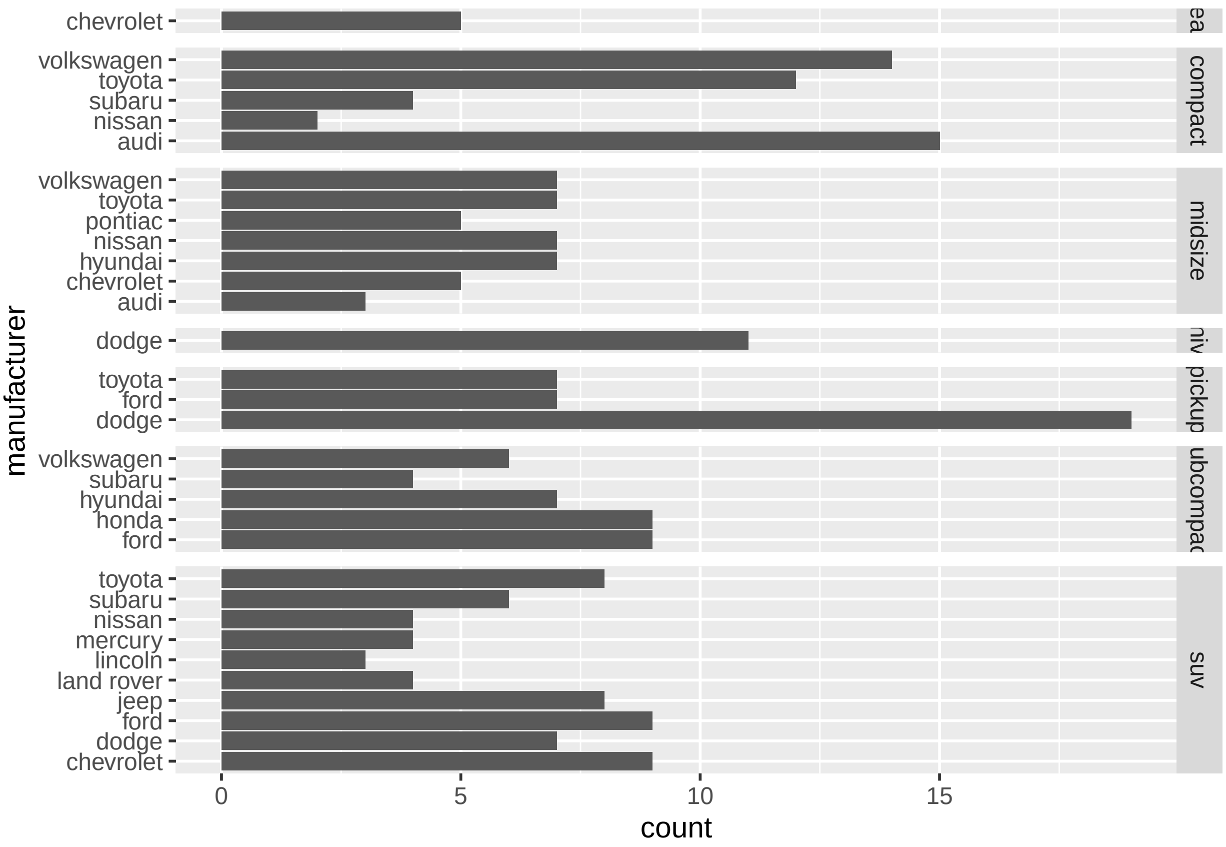
```
ggplot(mpg) +
  geom_bar(aes(y = manufacturer)) +
  facet_grid(class ~ .)
```



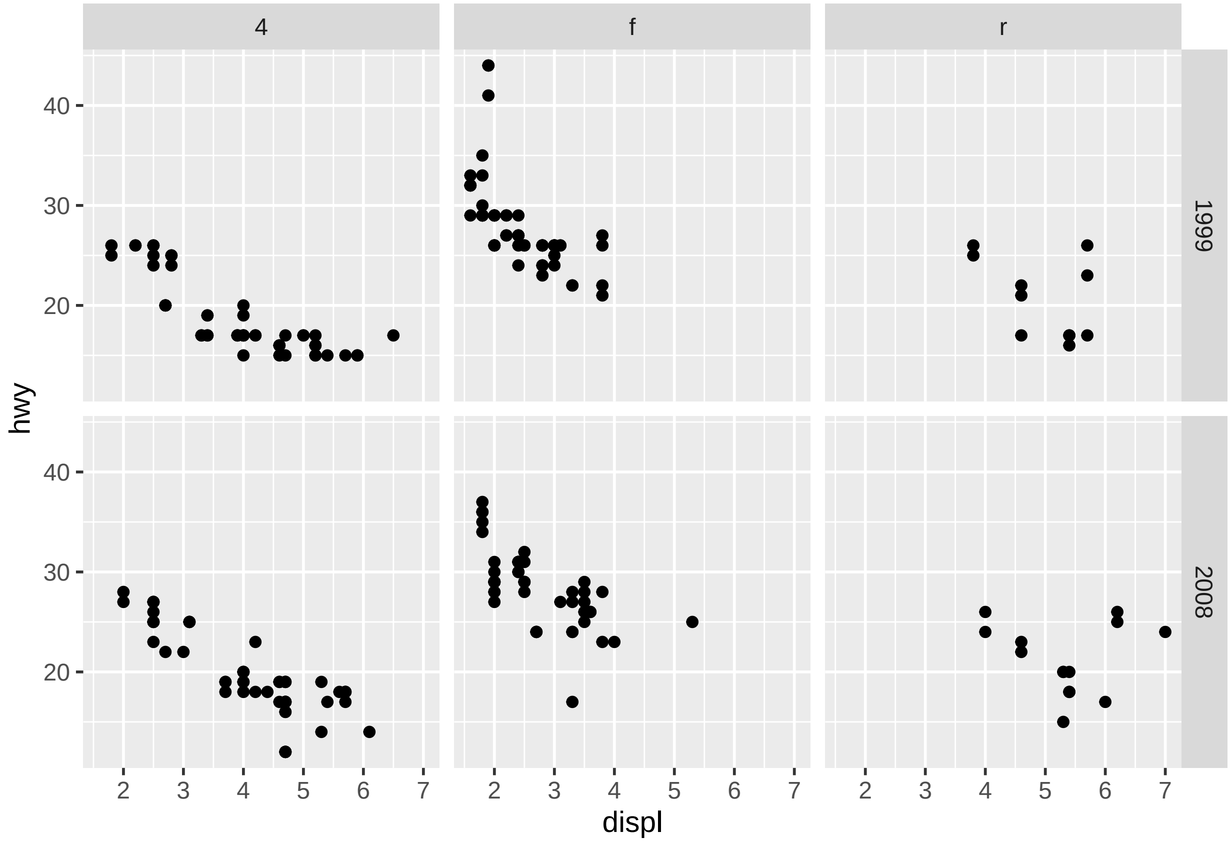
```
ggplot(mpg) +
  geom_bar(aes(y = manufacturer)) +
  facet_grid(class ~ ., scale = 'free_y')
```



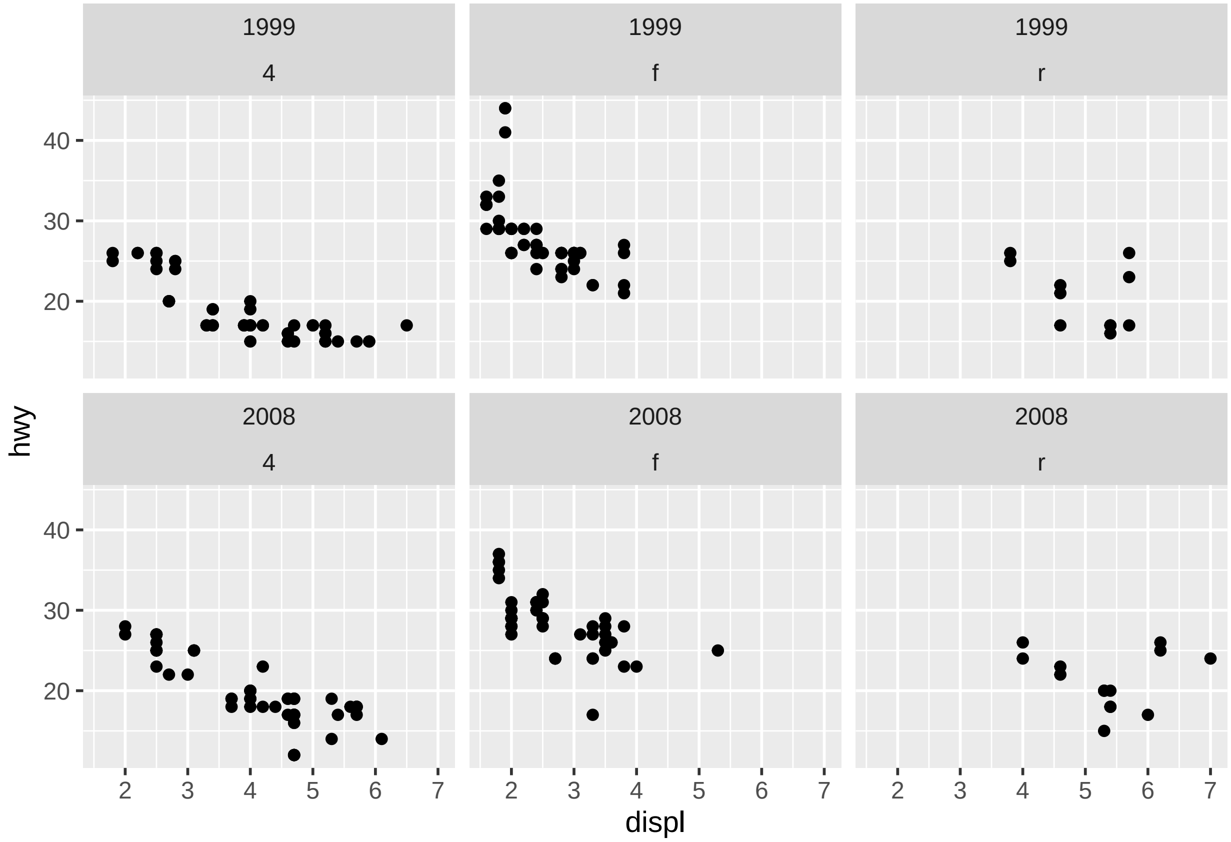
```
ggplot(mpg) +
  geom_bar(aes(y = manufacturer)) +
  facet_grid(class ~ ., space = 'free_y', scale = 'free_y')
```



```r
ggplot(mpg) +
  geom_point(aes(x = displ, y = hwy)) +
  facet_grid(year ~ drv)
```

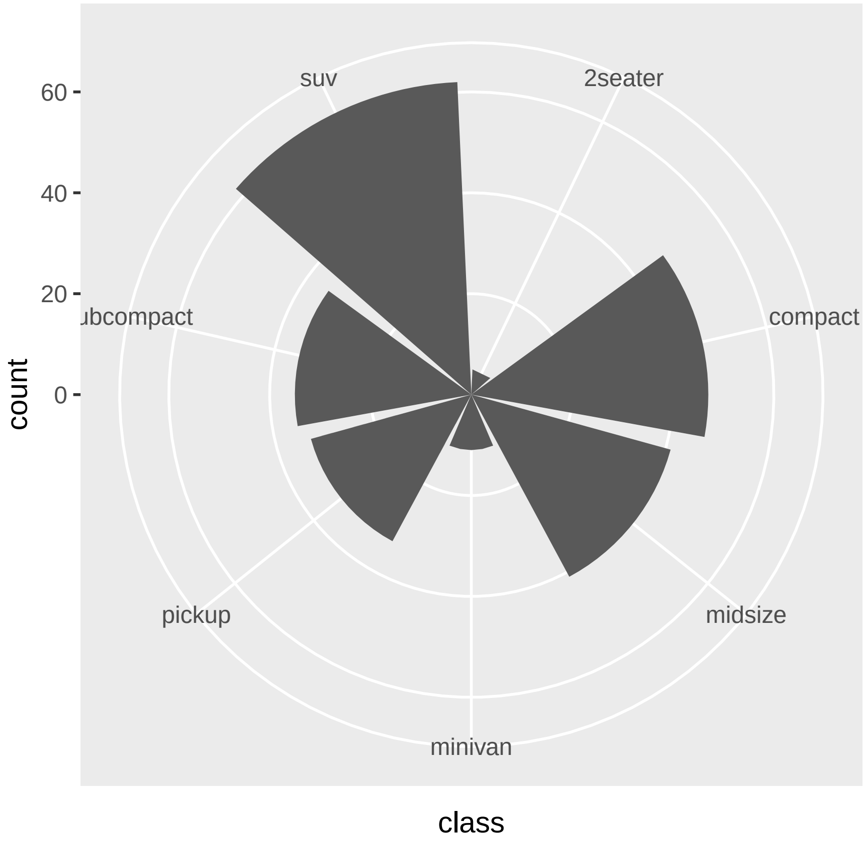


```
ggplot(mpg) +
  geom_point(aes(x = displ, y = hwy)) +  #Less affective way of using it but sure here it is
  facet_wrap(~ year + drv)
```

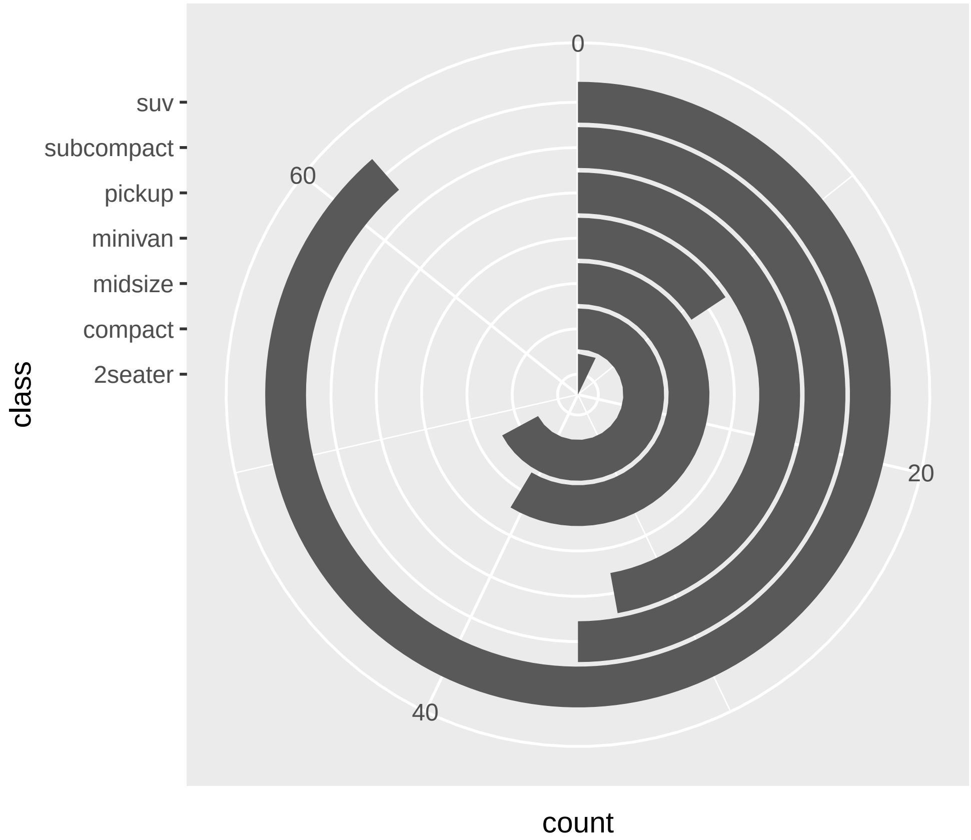


### COORDINATES

```
ggplot(mpg) +
  geom_bar(aes(class)) +
  coord_polar()
```

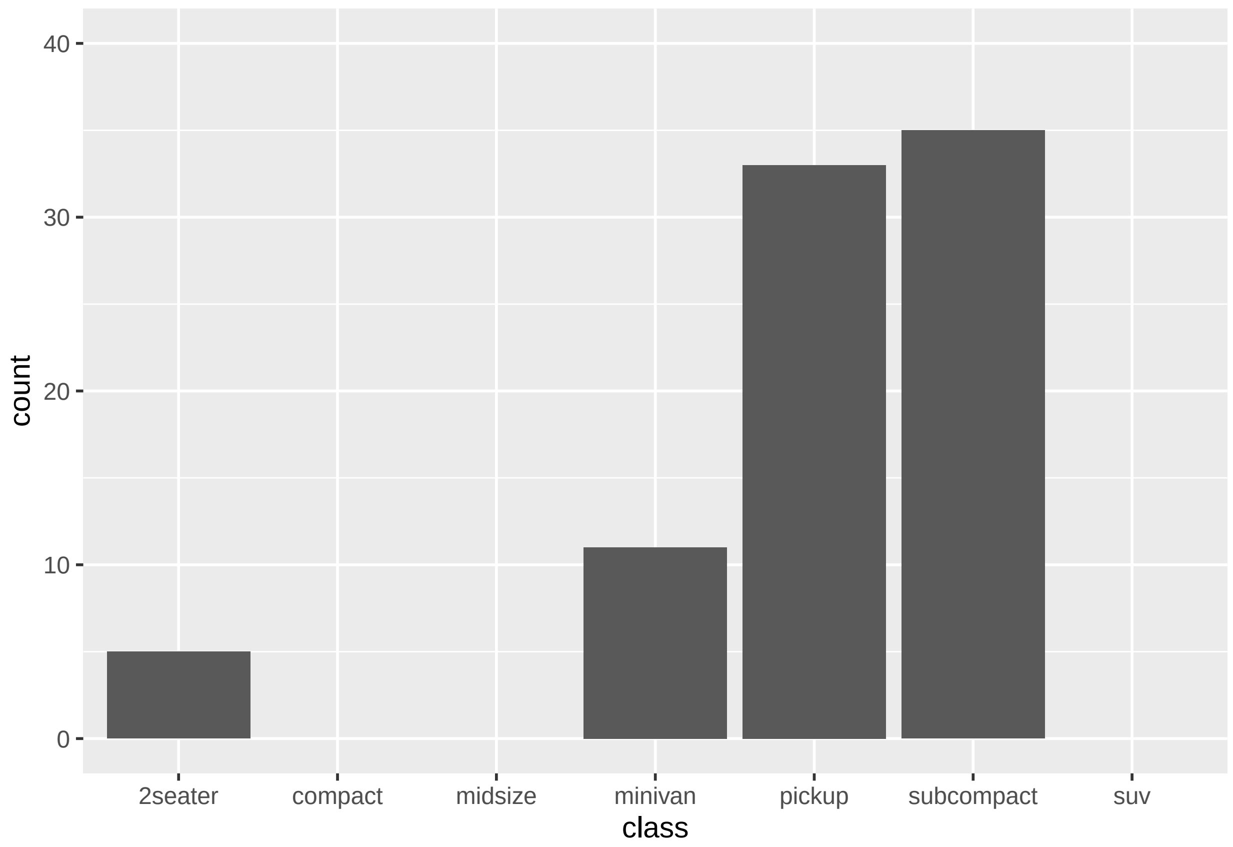


```
ggplot(mpg) +
  geom_bar(aes(class)) +
  coord_polar(theta = 'y') +
  expand_limits(y = 70)
```

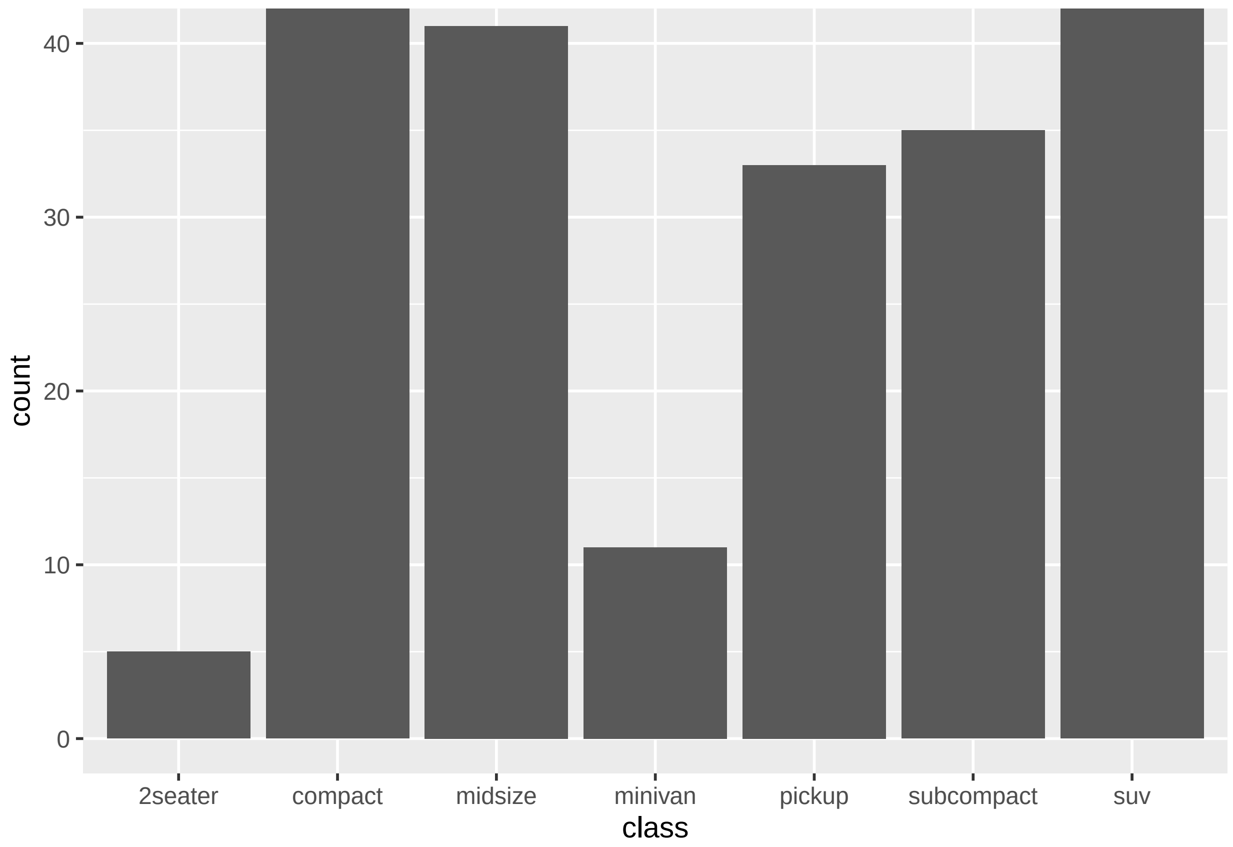


```
ggplot(mpg) +
  geom_bar(aes(class)) +
  scale_y_continuous(limits = c(0,40)) #you're trying to zoom in to your plot but if you try to set the
```

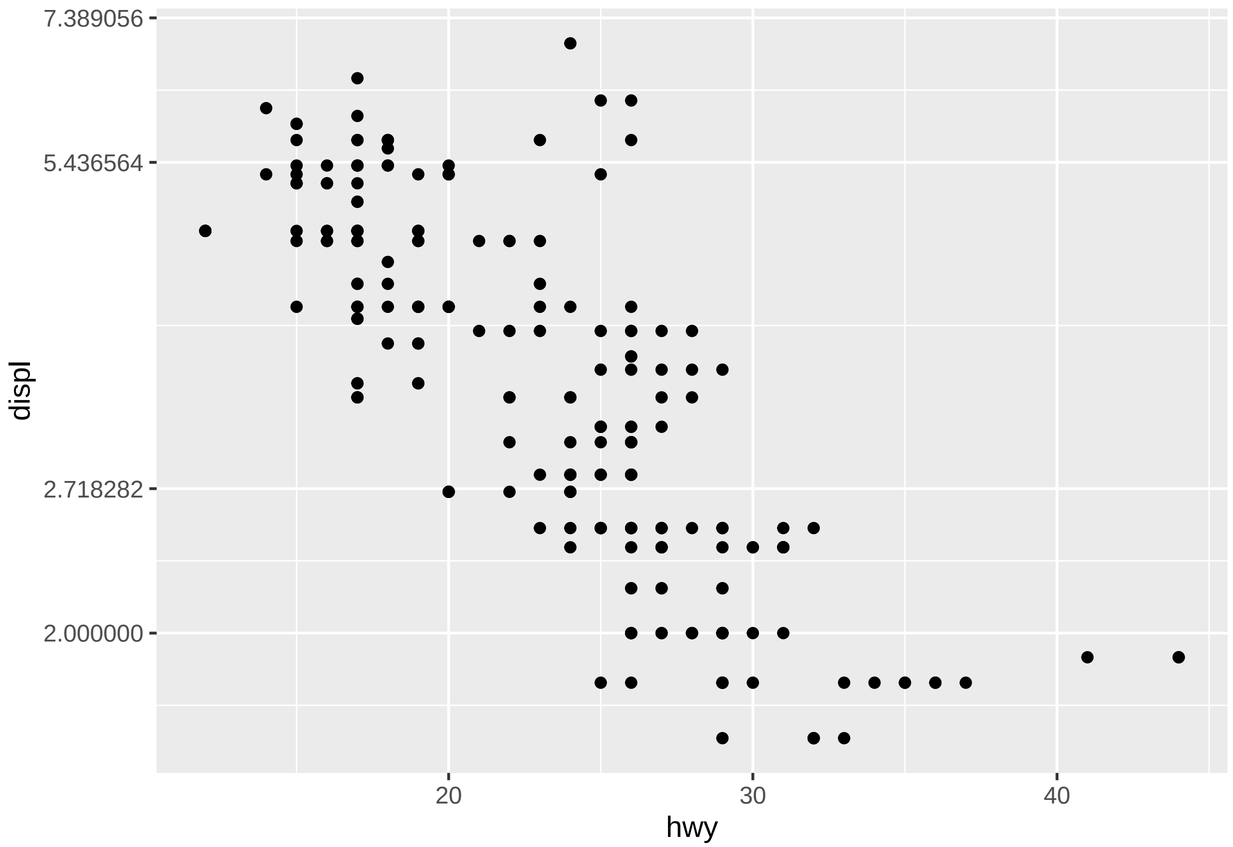
```
## Warning: Removed 3 rows containing missing values (geom_bar).
```



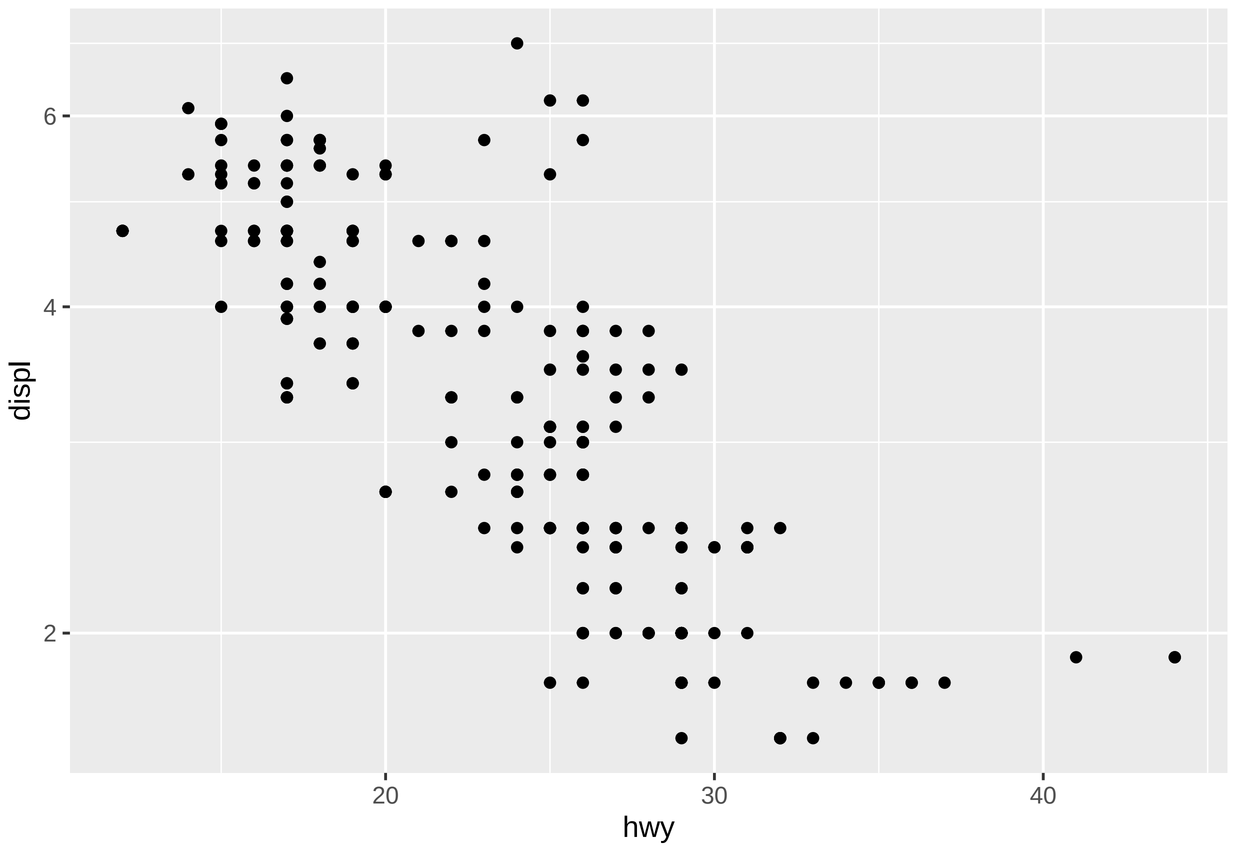
```
ggplot(mpg) +
  geom_bar(aes(class)) + #that is why you set the limits in the coordinate system instead, doesnt mess
  coord_cartesian(ylim = c(0,40))
```



```
ggplot(mpg) +
  geom_point(aes(hwy, displ)) +
  scale_y_continuous(trans = 'log')  #breaks are horrible, because i'm doing it in scale
```

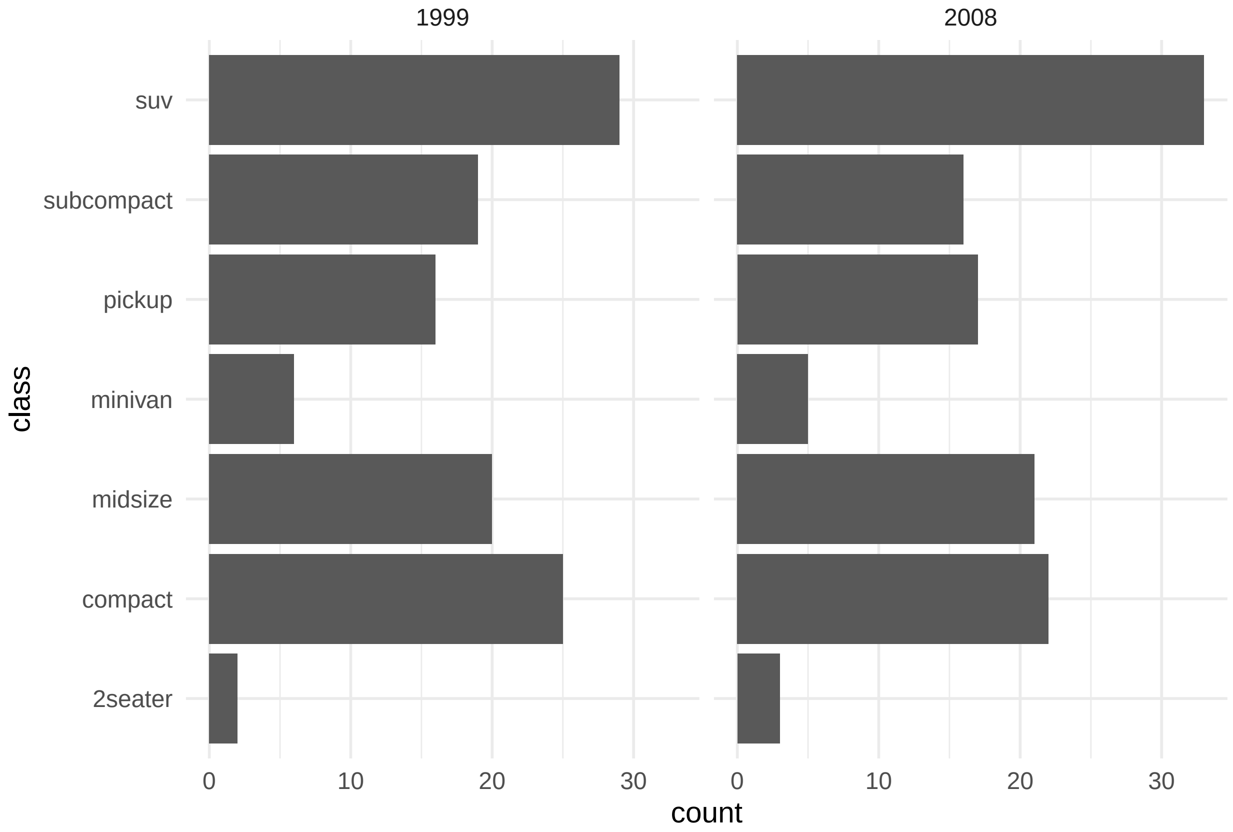


```
ggplot(mpg) +
  geom_point(aes(hwy, displ)) +
  coord_trans(y = 'log')  #This only stretches the fabric after the calculations have been done to crea
```



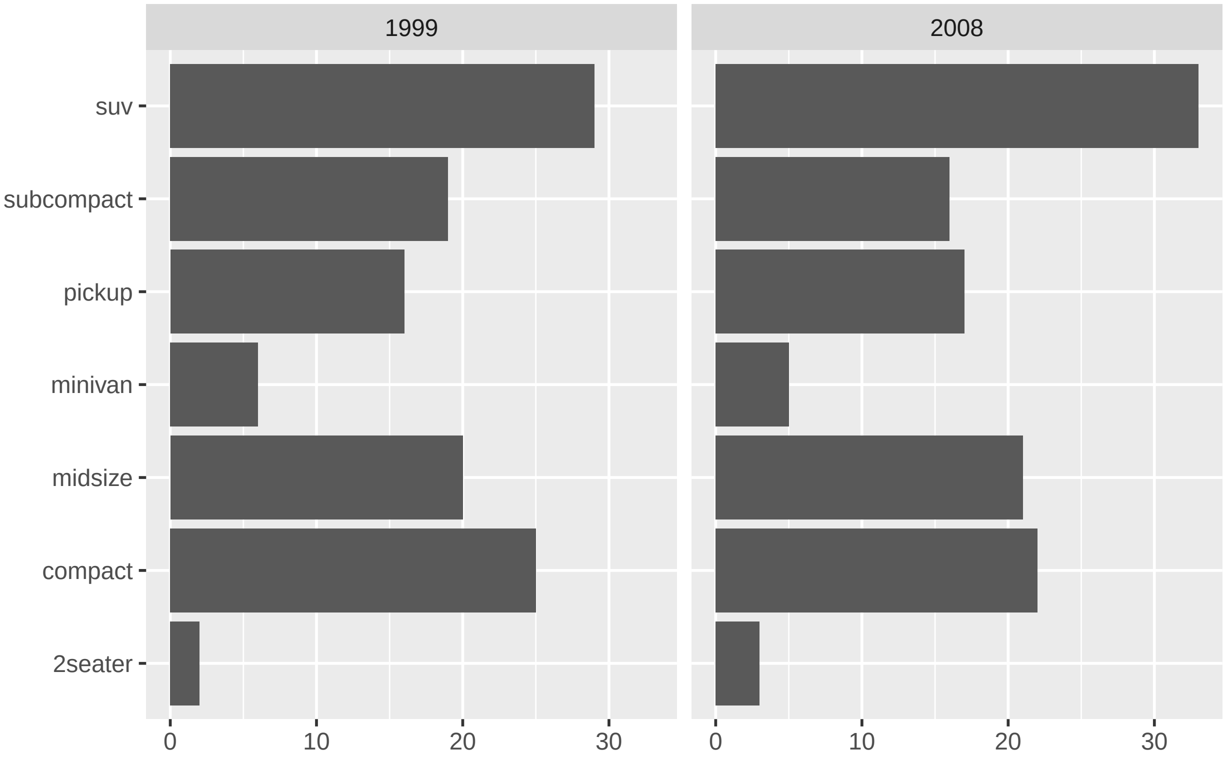
### THEME

```
ggplot(mpg) +
  geom_bar(aes(y = class)) +
  facet_wrap(~year) +
  theme_minimal()
```



```
ggplot(mpg) +
  geom_bar(aes(y = class)) +
  facet_wrap(~year) +
  labs(title = "Number of car models per class",
       caption = "source: http://fueleconomy.gov",
       x = NULL,
       y = NULL)
```

Number of car models per class


1999

2008

source: http://fueleconomy.gov